DOMESTIC PRODUCT MANUAL

GENERAL ELECTRIC

REFRIGERATING MACHINES

DR MACHINES

GENERAL ELECTRIC COMPANY
APPLIANCE AND MERCHANDISE DEPARTMENT
BRIDGEPORT
CONNECTICUT

INTRODUCTION

Every General Electric Refrigerating Machine is carefully designed, manufactured, tested, and inspected in the factory in order to give satisfactory refrigerating service. Although these refrigerating machines are designed and manufactured to give many years of service with a minimum amount of attention, occasionally there will arise conditions or circumstances which will necessitate adjustment by a competent service man.

While only a relatively small percentage of General Electric refrigerating machines require such special service, much of which is of a minor nature, still it must be remembered that every service call represents a critical point in the customer's goodwill toward the General Electric Company, the distributor, and the dealer outlet from whom the refrigerator was purchased. Consequently, the service required should be rendered quickly, courteously, efficiently, and effectively.

This material is prepared as a reference and a guide to assist the service man in giving competent service. A careful inspection of the way it is indexed and divided into sections will show that, while much information is included, it is so arranged that various details can be easily located. Although the great majority of service men will use but a few of the adjustments given, the less common adjustments are also included so that they are available if they should ever be needed.

This Section of the Product Manual for Domestic Refrigerators covers Type DR Refrigerating Machines which were manufactured and sold from 1927 through 1932. The manual is divided into six general sections covering: Description of Type DR Refrigerating Machines, including complete nomenclature, specifications, and pictures of all machines; Controls and Control Adjustments, including pictures and wiring diagrams; Odd Frequency and Direct Current Machines, with rotary converters, wiring diagrams and a-c d-c adapters; Service Adjustments, giving first normal operation and then instructions on general, machine, control and educational service; Installation of Refrigerating Machines; and finally general service notes on Cabinet Adjustments and Replacements. In general this Manual is written on the basis of original machines. However, some rebuilt machines may differ slightly from the original machines, particularly the color of wires, but it is usually obvious, and so the service adjustments are the same.

This Section is only one of the several sections that comprise the General Electric Domestic Refrigerator Product Manual. These sections give in detail product information on General Electric domestic refrigerators.

Form 8-496-DR
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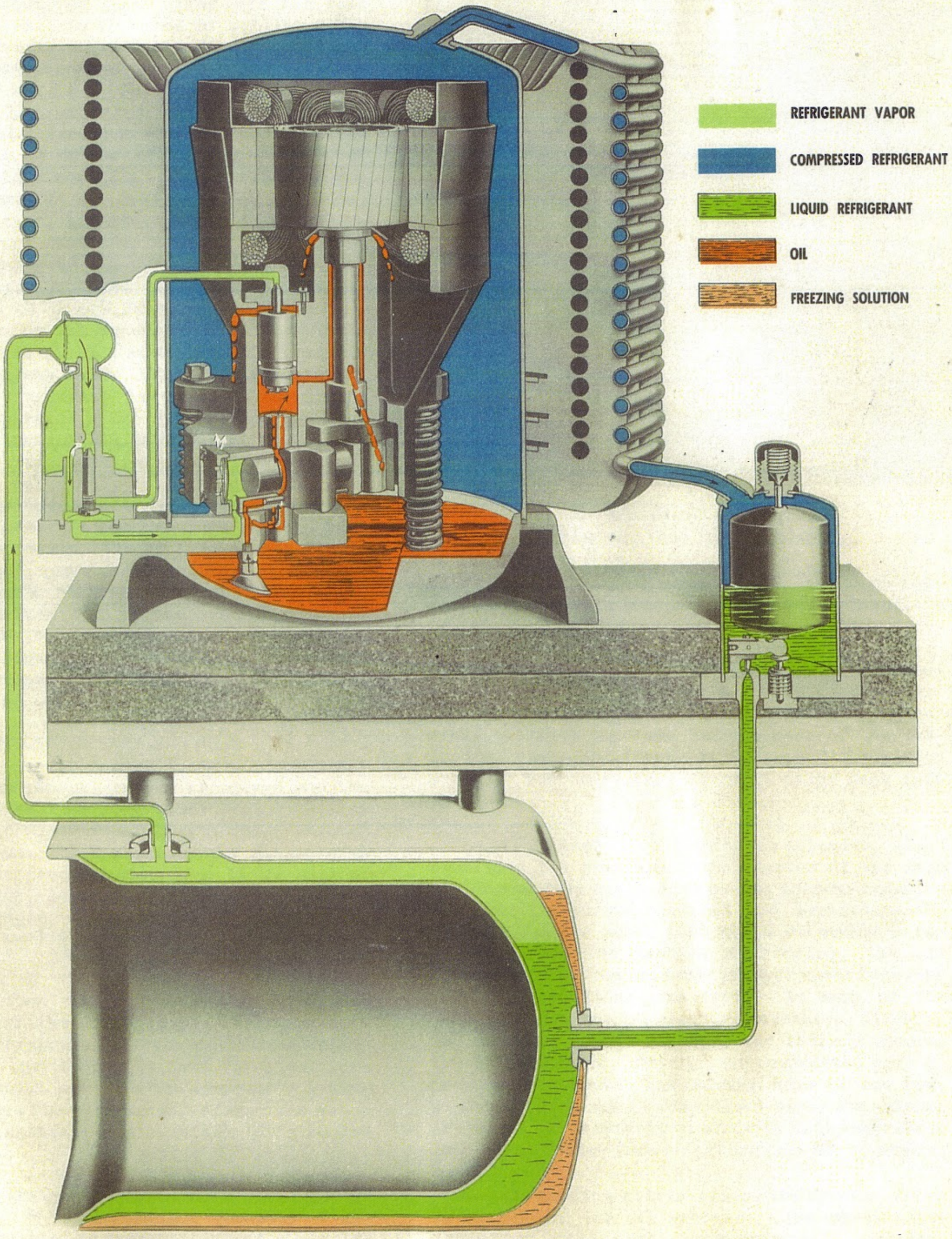
Showing Operation of Type DR Refrigerating Machine



Type DR Refrigerating Machines

GENERAL

Mechanical refrigeration is based on the principle that when a liquid boils or changes to a vapor, it absorbs heat, and this vapor on being condensed or liquefied again gives off the same heat it absorbed. In the case of boiling water at 212 F the steam or vapor produced absorbed heat. This heat absorbed by the vapor is known as *latent heat* and it is held dormant in the vapor - until the vapor condenses or liquefies again, when this latent heat, the heat absorbed by the boiling, is given off. The boiling of water takes place normally at temperatures too high to be of benefit for refrigerating purposes. There are, however, liquids which boil at temperatures low enough that they can be used for refrigerating purposes. In refrigerating machines these liquids are known as *refrigerants*. The refrigerant used in General Electric Type "DR" Machines is sulphur dioxide of which more will be said later. This boils at 14 F at atmospheric pressure or about 18 degrees below the freezing point of water. The refrigerant is admitted in liquid form to the evaporator in the cabinet and the heat of the cabinet causes the refrigerant to boil or vaporize. The resultant refrigerant vapor laden with heat, but relatively cold, is drawn into the compressor, and compressed to several times the incoming pressure. As the pressure on this heat laden vapor increases, the heat manifests itself in an increased vapor temperature. When this comparatively warm compressed vapor is discharged into the condenser and cooled, enough heat is dissipated from the compressed vapor to cause it to condense or liquefy. It is then ready to pass back to the evaporator and perform its heat-removing functions over again.

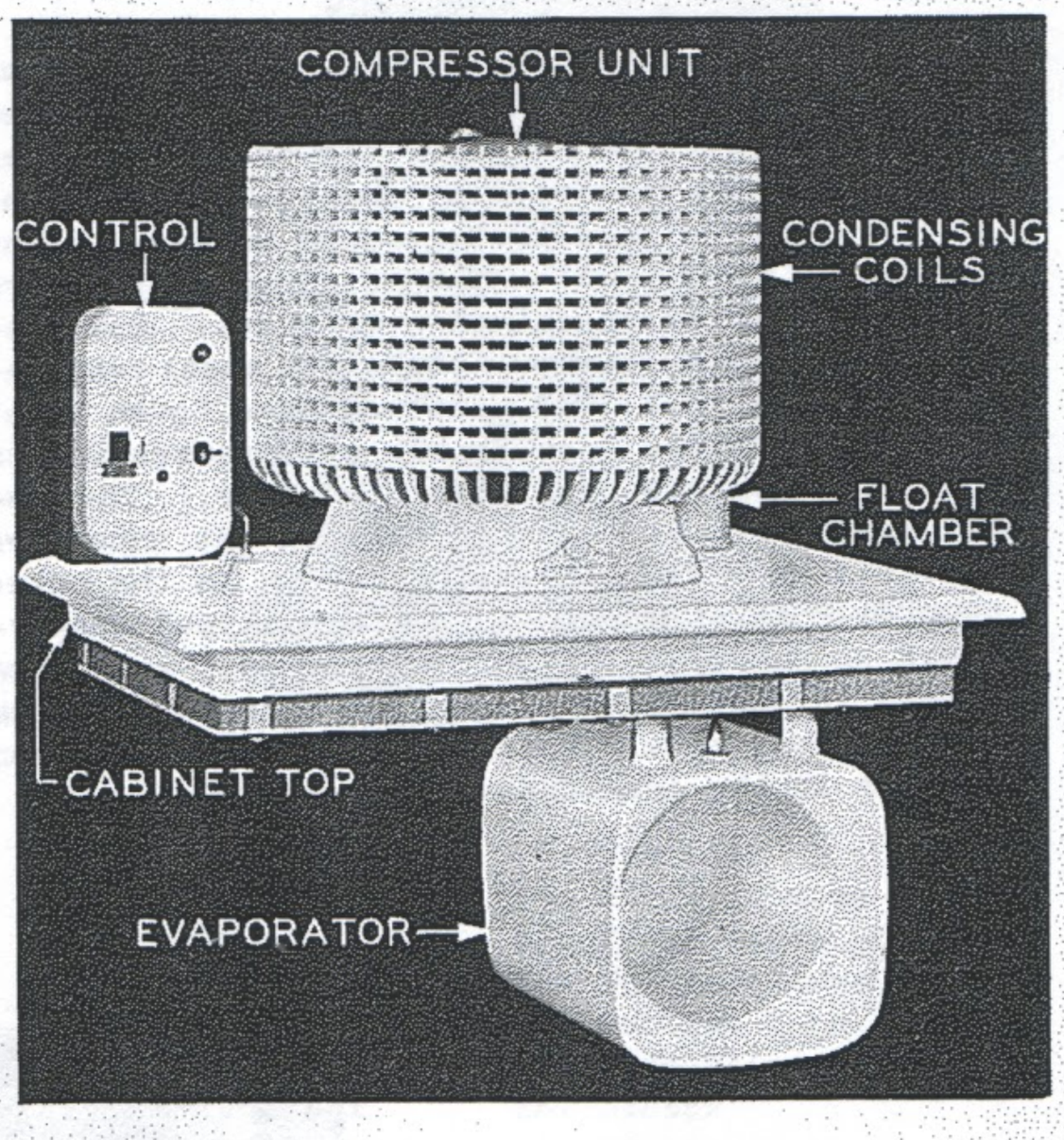


Fig 1. Type DR-2-D Refrigerating Machine with Oven Type Evaporator

CYCLE OF OPERATION

When the main control switch is closed and the motor is started, the compressor begins to draw the refrigerant vapor from the evaporator through the suction line. This reduces the pressure on the liquid refrigerant and allows it to boil or evaporate freely. As the refrigerant changes from a liquid to a vapor, it absorbs heat from the interior of the refrigerator cabinet.

The function of the rest of the refrigerating mechanism is then to reliquefy this vapor and feed it back to the evaporator. The compressor drawing the refrigerant vapor from the evaporator, compresses it and forces it into the steel compressor case which encloses the compressor assembly. From there the compressed refrigerant vapor passes to the condenser coils, where it is cooled and liquefied.

The liquid refrigerant then drains down into the float chamber. When a sufficient quantity of liquid has accumulated to raise the float, the valve is opened, permitting some of the liquid refrigerant to run back into the evaporator to complete the cycle.

The moving parts of the motor-compressor assembly are liberally oiled by a forced feed system. A small piston attached beside the main piston, draws oil from the sump in the base of the compressor case, and forces it up around the piston and main bearings, from where it drips back into the sump.

The oil pressure also operates an unloader, which equalizes the pressure on both sides of the main piston whenever the machine stops, thereby reducing the starting torque required and permitting the use of a smaller motor than would otherwise be required. When the machine is running, the oil pressure forces the unloader plunger upward thereby closing a small by-pass valve. As soon as the machine stops, the oil pressure decreases, allowing the unloader plunger to drop, and thereby opening the by-pass valve. This allows compressed refrigerant vapor to enter the suction side of the compressor. The rush of compressed vapor also closes the check valve thereby preventing this compressed refrigerant vapor from returning into the evaporator.

When the machine starts again, the by-pass valve is closed by the oil pressure, the check valve drops open, and the unit resumes normal operation.

DESCRIPTION

TYPE "DR" REFRIGERATING MACHINES

All the Type "DR" domestic refrigerating machines are Monitor Tops except the DA-1-L1 and L2 machines which were designed for under-the-drain installations. All are hermetically sealed. The condenser is made of copper tubing wound on fins on the compressor case. All of the original evaporators are white porcelain enamel over steel. Some reconditioned machines have stainless steel evaporators. Early Type "DR" machines have "oven type" (sometimes called "pig type") evaporators formed with three shells, one within another. The refrigerant is in the chamber between the inner two shells and a freezing solution is in the outer chamber. Later machines have "open-type" evaporators which have a header at the top, and tubes formed in steel sheets for the sides and bottom freezing surfaces. There is no freezing solution chamber in the open-type evaporator.

COMPRESSOR

The compressor is contained within the drawn-steel compressor case and is mounted on three springs protruding from the base. On earlier machines the compressor case is connected to the forged steel base with a tongue-and-groove aluminum-gasketed joint and is held by special forged bolts. On later machines the compressor case is welded to a drawn steel base.

The motor stator is mounted on the top of the main frame, near the top of the compressor case. The refrigerant pump is mounted in the bottom of the main frame just above the oil reservoir formed by the base. The rotor of the motor is pressed on the top of the vertical case-hardened shaft which rotates in two hardened steel bushings, one in the top and the other in the bottom of the main frame.

The steel piston has no rings but depends on a close fit with the cylinder bore and an oil pressure seal. It is driven directly from the crankshaft, that is, the piston stroke is not on a constant

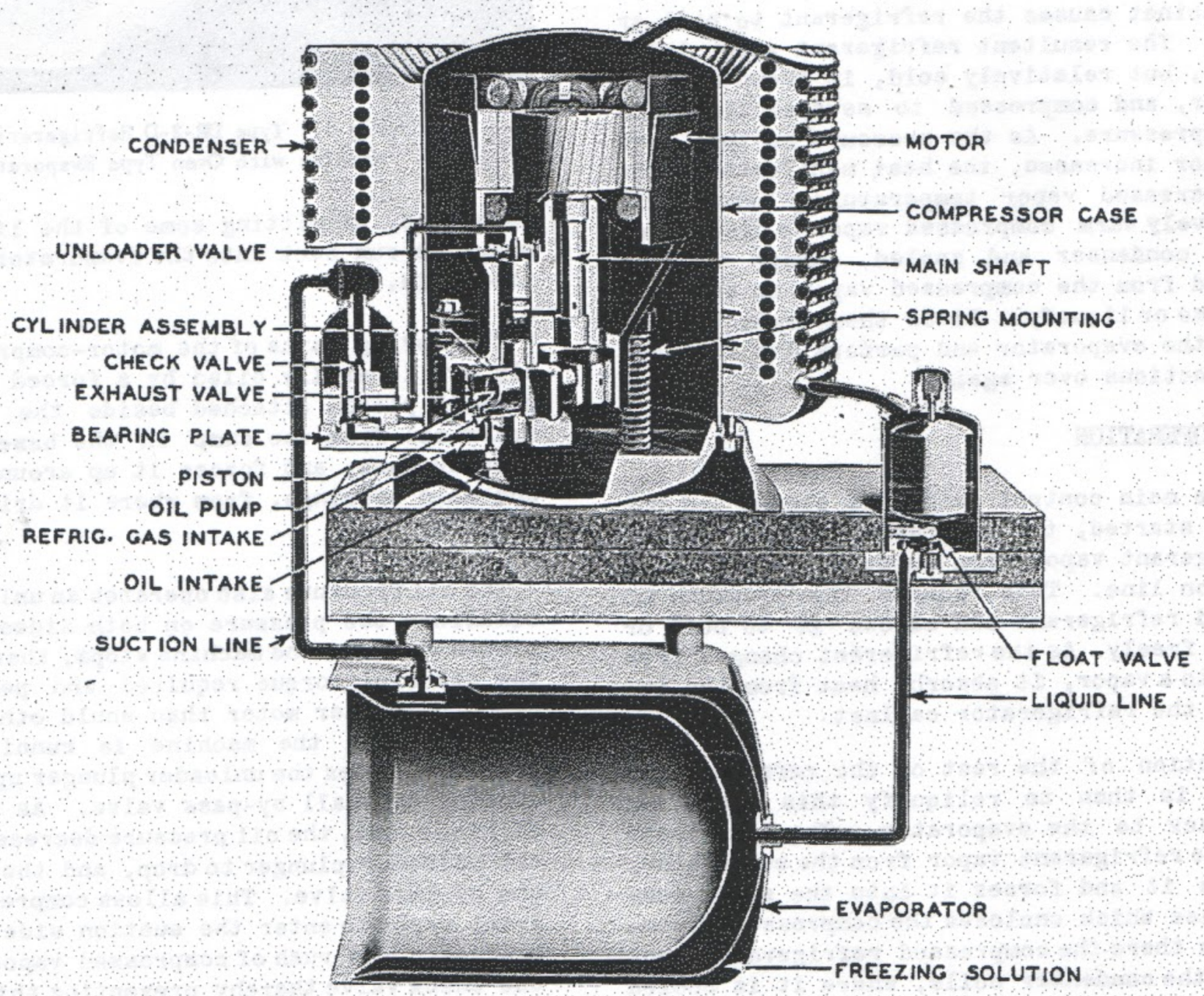


Fig. 2. Schematic Diagram of Type DR Refrigerating Machine

axis and consequently must oscillate some to compensate for the side throw of the crank pin. The cylinder block, therefore, is mounted on two vertical trunnions, approximately in the center of the cylinder, and the entire cylinder block and piston assembly oscillates in a pocket in the bottom of the compressor frame. The upper trunnion fits in a bronze bushing in the main frame, above the cylinder pocket and at the bottom of the unloader chamber. The lower trunnion fits in a similar bronze bushing in the forged steel bearing plate which is bolted to the main frame below the cylinder pocket. The cylinder block rides on the bearing plate as it oscillates on the trunnions.

The inlet port in the cylinder registers with a corresponding port in the bearing plate during the suction stroke, but after the cylinder turns through a certain angle, the ports do not register and, therefore, the inlet port is closed during the compression stroke.

A passage in the bearing plate leads from the inlet port to the check valve, which is in the suction line between the evaporator and the compressor. During the "off" period, the check valve shuts off the suction tube so that high pressure refrigerant in the compressor case cannot leak back to the evaporator. Its operation is further explained later in this section along with the unloader.

Over the end of the cylinder opening is a discharge valve plate known as the "muffle box". A steel disk valve covers the whole end of the cylinder opening. It is backed by two circular spring disks which flex around their circumference, being backed in the center by a button raised from the center of the hardened steel muffle box.

Compressed refrigerant vapor from the muffle box passes through a series of chambers formed by the cylinder fins in the cylinder pocket in the main frame. These chambers act as an acoustic muffler to eliminate noise. The compressed refrigerant vapor then passes out into the compressor case, which is on the high pressure side of the machine.

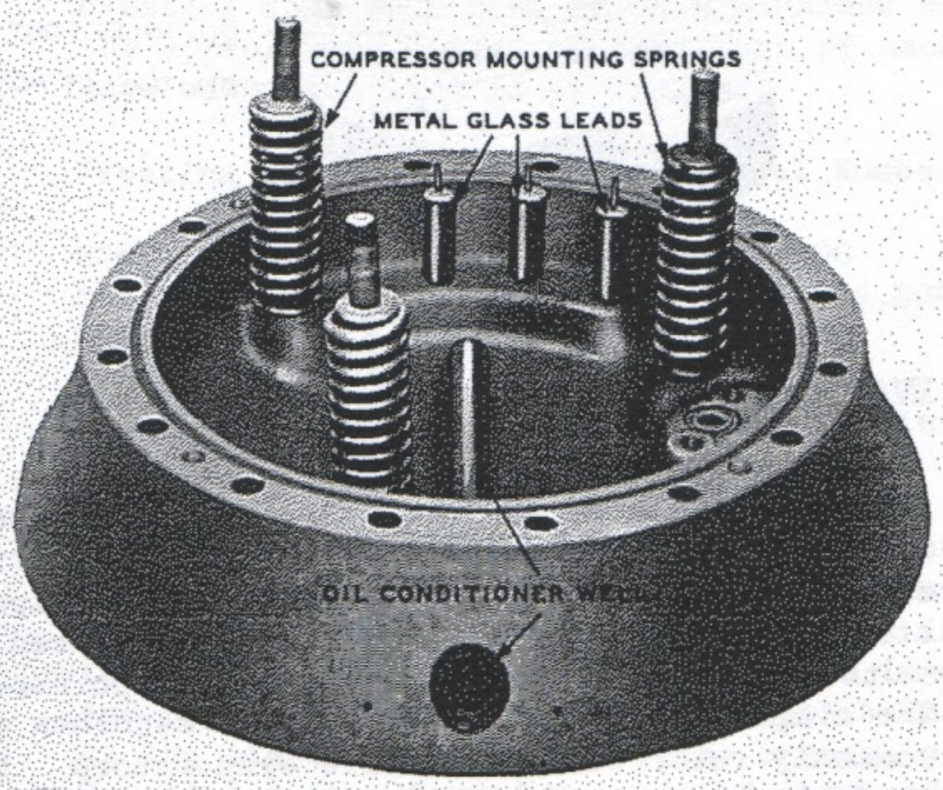
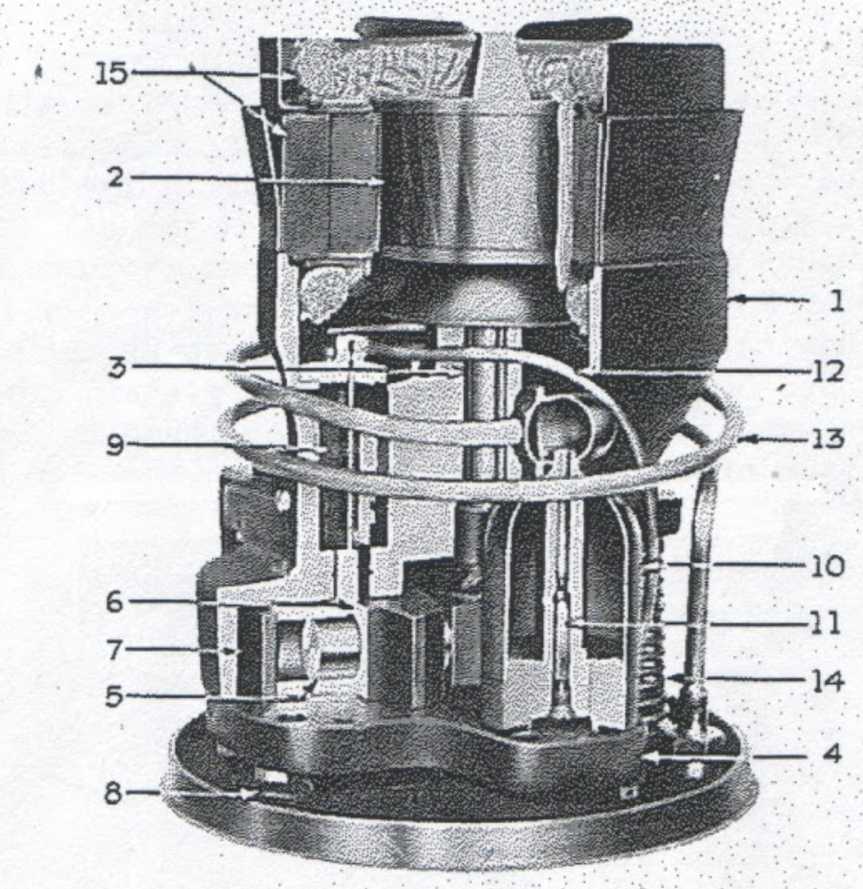


Fig.3 Compressor Base



1. Main frame
2. Rotor
3. Main shaft
4. Bearing plate
5. Piston
6. Cylinder
7. Muffle box
8. Oil screen
9. Unloader
10. Surge chamber
11. Check valve plunger
12. Unloader tube
13. Suction tube
14. Supporting springs
15. Stator

Fig.4 Cut-Away of Type DR Refrigerating Mechanism

OIL CONDITIONER

A sealed steel tube extends into the oil sump in the compressor base. It is welded in the base in such a manner that its open end comes outside the base. A small 12-15 watt electric heater, known as an oil conditioner, is contained in the tube. The oil conditioner is connected across the electric service so that current passes through it as long as the connecting cord is plugged into electric service. Its purpose is fundamentally to prevent the condensation of refrigerant in the oil. It also thins the oil particularly in cool room temperatures, and thus makes some saving in the power drawn by the motor.

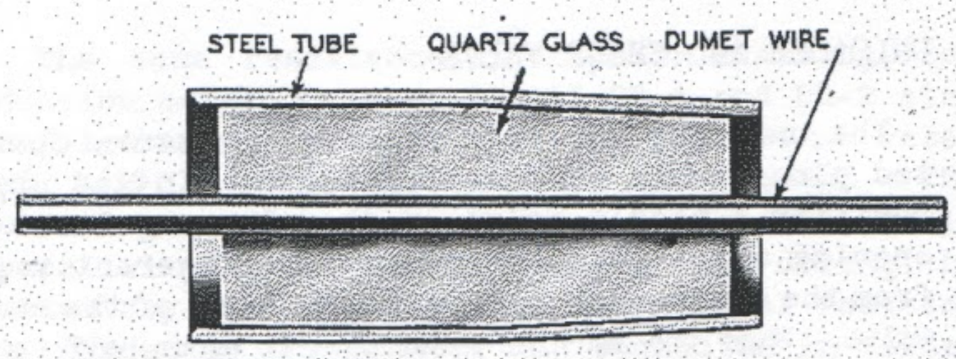


Fig.5 Metal Glass Lead

OIL PUMP

The oil pump consists of a small piston mounted beside the main piston and operating in phase with the compressor piston. Oil is drawn into the oil pump cylinder through small ports in the cylinder which register with similar ports in the bearing plate. The inlet port connects to the oil screen in the oil sump in the base. The outlet port leads to a hole in the center of the lower cylinder trunnion, from where the oil passes up through a groove in the cylinder around the piston, through the center of the upper cylinder trunnion to the bottom of the unloader chamber.

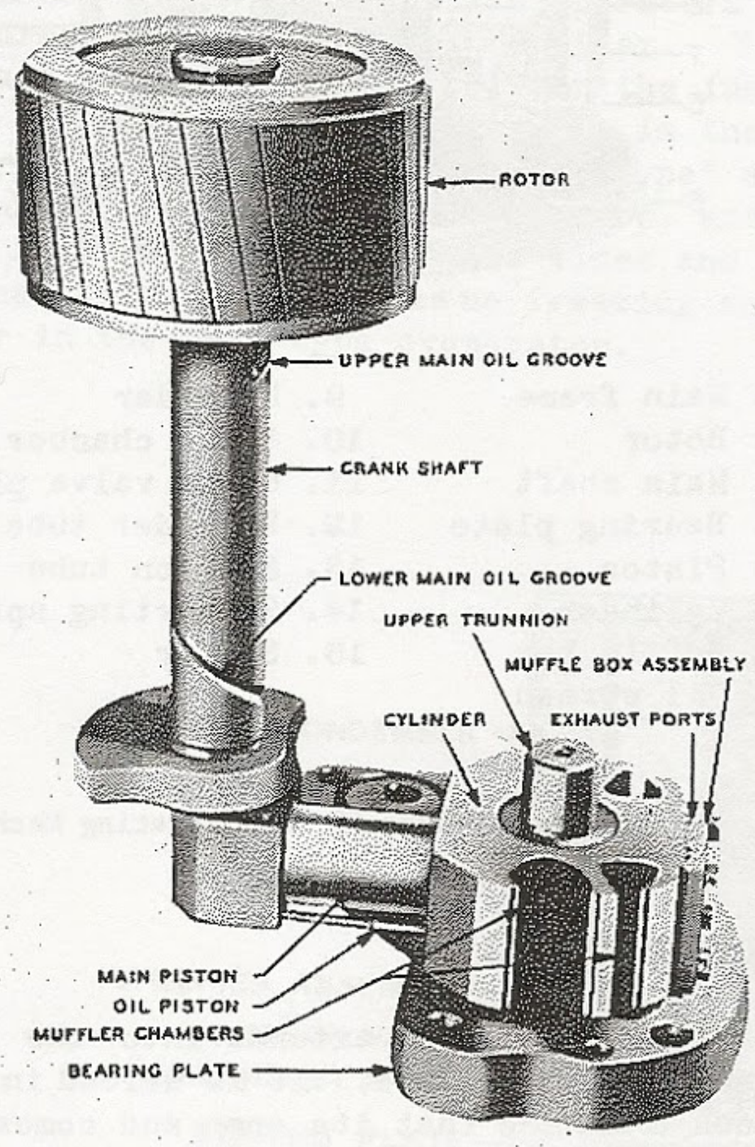


Fig. 6 Compressor

From the unloader chamber the oil goes to a passage in the main frame around the shaft. Spiral grooves in the shaft lead the oil to the upper and lower shaft bearings. Another passage takes some of the oil to the crank pin bearing. Most of the oil spills out over the top of the upper shaft bearing, and is deflected downward away from the motor by an oil deflector.

UNLOADER AND CHECK VALVE

The unloader consists of an oil pressure operated plunger in a vertical cylinder. In its upper position a needle valve on the plunger closes an opening which leads compressed refrigerant vapor from the compressor case into the base of the check valve. When the machine slows down to about half speed, the oil pressure is reduced, and the plunger drops. Compressed refrigerant vapor comes up under the check valve and closes off the evaporator from the high pressure side of the machine. The compressed refrigerant also goes through the passage in the bearing plate into the cylinder so that the pressure within and outside the cylinder is now the same and the machine can start without load until the oil pressure raises the unloader again.

REFRIGERANT

Sulphur Dioxide (SO_2) is used for the refrigerant in all Type "DR" machines.

CONDENSER

All Type "DR" condensers are cooled by natural-draft air circulation. They consist of copper tubing wound concentric with the compressor case on fins projecting out from the compressor case. On the earlier models the fins were welded to the case but on later models (DR-1A, DR-1B, D-2-A) a strip type fin known as the "Candy-ribbon" or "Inverted fin construction" type was pressed on the case.

FLOAT VALVE

The float valve, located in the right rear corner of the cabinet top, includes a cylindrical bulb working up and down on a center rod and operating a needle valve on a simple lever mechanism. The purging screw in top of the float valve shell holds the rod against the coil spring in the bottom of the float. By unscrewing the purging screw eight complete turns the float may be raised to open the valve.

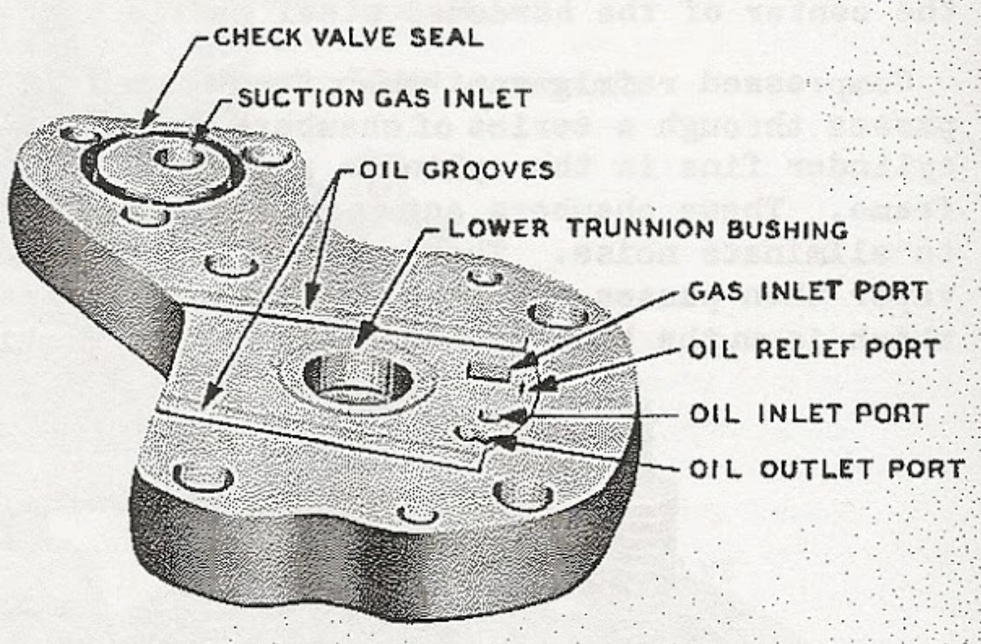


Fig. 7 Bearing Plate

EVAPORATORS

The evaporator is located on the under side of the cabinet top as an integral part of the whole refrigerating machine. On the original production of Type "DR" machines two general types of evaporators were used. They are commonly referred to as the "oven" (pig) and "open" type of evaporators. The evaporators used on the DR-3 size machines are commonly referred to as double evaporators. Reconditioned machines normally have the same type of evaporator as was used on the original machine,

but in some cases stainless steel evaporators are substituted and the form letter is changed for that machine.

A *Oven Type Evaporator:* The oven type evaporator is made of three drawn steel shells, nested one within the other and welded together around the joint where the three come together. The whole assembly with the inlet and outlet connections is hydrogen brazed. The evaporator is finished in white porcelain enamel. The inner and intermediate shells are of circular cross-section and the outer shell of nearly square cross-section. With this construction there are two separate compartments, the outer of which contains a freezing solution, and the inner the liquid refrigerant under low pressure for evaporation.

The liquid refrigerant is admitted from the float valve to the evaporating compartment of the evaporator, where it evaporates, absorbing heat from the freezing solution. The freezing solution is constantly absorbing heat from the interior of the cabinet and at the same time provides a means whereby the machine may store up additional energy for use during the "off" part of the cycle.

The double evaporators used on some DR-3 size machines consist of a porcelain enameled sheet steel tank with the freezing compartment surrounded by coils through which the refrigerant circulates.

The oven-type evaporator used on DRA-2-D or E machines is shorter than the one used on DR-2 or DR-3 size machines.

Because the inner freezing surface is cylindrical in form, a freezing block is placed in it to give a flat surface for the ice tray. At first, this block was made of cast iron, porcelained white. Later it was changed to extruded aluminum.

Freezing solutions used in DR-2 machines and the approximate serial number range of machines with each kind is as follows:

Freezing Solution	Machine Serial Numbers
20% glycerine	below 136,000
Sun Oil	136,000 to 294,000
40% potassium carbonate	above 294,000

All reconditioned machines have a 40% potassium carbonate freezing solution.

B *Open-Type Evaporator:* The open type evaporator was introduced on the DR-1A machine. It consists of two steel sheets pressed into shape so that the upper part of the inner and outer sheets formed a cylindrical header at the center on the top of the evaporator. Forged end caps formed the ends of the header and included the legs which connected the

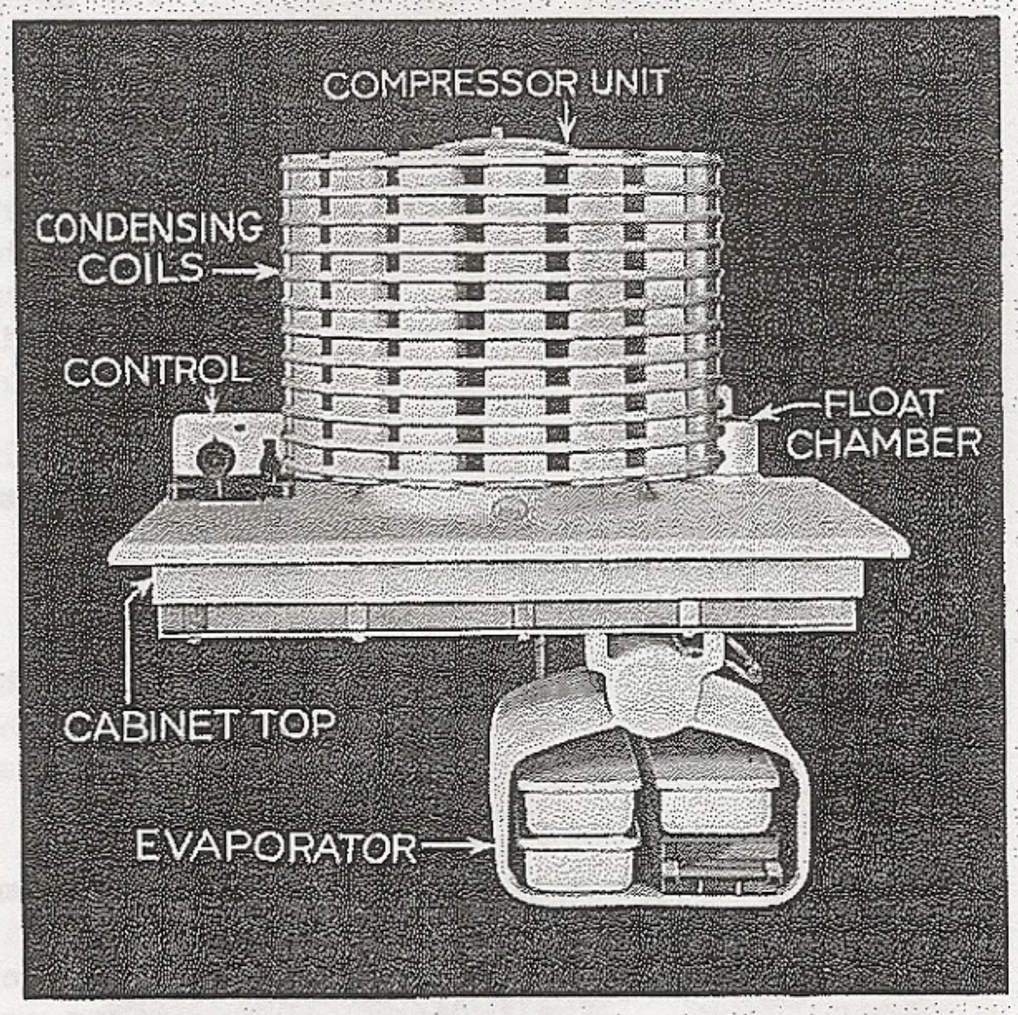


Fig. 8 Type D Refrigerating Machine with Open Type Evaporator

evaporator to the bottom plate. The outer sheet is corrugated to form a series of parallel channels connecting to the header. The whole evaporator is hydrogen brazed and finished in white porcelain enamel.

There is no freezing solution used with open-type evaporators.

The ice tray compartment in the first open-type evaporator on the DR-1A machine is oval in shape with the bottom flattened to give a good freezing surface for the wide bottom ice tray. A second ice tray lies on the lower one.

For the DR-1B machine, the ice tray compartment is wider but not as high so that two narrower ice trays lie side by side in direct contact to the freezing surface.

The open-type evaporator used on DR-2-F and D-2-A machines is larger so that it holds four medium width ice trays; two in contact with the bottom freezing surface and two on top of them.

MOTOR

The same resistance split-phase starting, induction motor is used in all DR-1 and DR-2 size refrigerating machines. The DR-1 size is rated at 1/10 and the DR-2 at 1/8 horsepower. The starting winding is connected in the circuit in parallel with the running winding only during the momentary starting period. An external resistor is placed in the control and connected in series with the starting winding.

Early DR models had copper bar squirrel-cage

rotors but beginning with the DR-1-B and later in DR-2-F machines, a cast aluminum rotor was used.

A capacitor start and run split-phase induction motor is used in DR-3 and DR-4 size machines. The DR-3 size is rated at 1/6 and the DR-4 at 1/3 horsepower. One point of the capacitor is in the circuit with the starting winding and then when the motor has come up to speed, the starting winding is connected to another point on the capacitor unit and thereafter the motor runs as a polyphase motor.

The capacitor on the larger machines serves the purpose of increasing the power factor and decreasing the starting and running current.

CONTROL

The control is located on the left rear of the cabinet top. On early models, it stands upright but beginning with the DR-1-A and DR-2-F models, it lies flat on the cabinet top.

The functions of the control parts are the same in all controls but various changes were made in the parts to improve the operation or protection of the machine. The fundamental functions and parts of all controls are as follows:

A *Main switch:* The main switch is used to turn the machine "on" or "off" manually and to reset the overload. In the original Type "A" control the moving of the main switch to the "off" position takes the stationary main contact back out of its normal position where it is usually held by the bimetallic overload strip. In all subsequent DR controls, the main switch unlatches the bimetallic overload strip and blocks the movable contact so that it cannot close.

Fig.9 Type C. Control

B *Bellows-operated temperature control:* The temperature within the refrigerator cabinet is controlled by regulating the temperature of the evaporator within certain limits, which, because of ice freezing, must be maintained below 32 F. The evaporator temperature is controlled by a bellows in the control which is connected to a tube external to the evaporator but in contact with the evaporator surface. A small amount of sulphur dioxide is charged into a sealed bellows and tube assembly. The vapor pressure of the sulphur dioxide in the bellows and bellows tube is proportional to the temperature of the liquid sulphur dioxide which remains in the coldest part of the bellows tube; that is, in the part in contact with the evaporator surface.

The bellows operates the bellows arm which in the Type "A" control moves the movable main contact through a latch arrangement and in all other controls moves a toggle arrangement which in turn operates the movable main contact.

C *Temperature Adjustment:* The bellows moves the bellows arm against the pressure of a coil spring. In all DR controls it is possible to adjust the pressure exerted by the temperature spring so as to change the evaporator limits. In the Type "A" control this adjustment is inside the control cover but the cover is easily removable. In all subsequent controls, this adjustment, is outside the cover where it can be readily made by the user. The amount of this adjustment was increased in later controls.

D *Overload Device:* All controls have an overload device to protect the refrigerating machine motor in case of unusual power conditions. It consists of a bimetallic strip next to a small heater grid which carries full line current. Any excess current passing through the grid causes additional flexing of the bimetallic strip until its end moves beyond the ledge, allowing the main switch to trip off. The main switch must be turned "on" manually to restart the machine.

In all except the Type "A" control, there is a compensating bimetallic strip which makes the operation of the overload independent of the ambient temperature.

E *Starting Device:* In all controls there is a starting arrangement for putting the starting winding of the motor in the circuit in parallel with the running winding during the momentary starting period. In the Type "A", "C" or "D" controls, this consists of a series coil in the circuit to the running winding which raises an armature and closes the starting

contacts. The contacts stay closed as long as the heavier starting current passes through the series coil but open as soon as the machine gets up to speed and the current is normal.

The Type "E" control has a slightly different starting arrangement which includes a shunt coil acting on a flapper armature in opposition to the series coil. When the machine is not running, the starting contacts are closed with the flapper against the series coil core. This gives better protection to the motor because it assures that both windings are in the circuit at the time of starting. The flapper stays in contact with the series coil core during the starting period but, as soon as the current in the series coil decreases, it is pulled over by the voltage coil and in so moving opens the starting contacts.

F *Starting Resistor:* In all of the 60 cycle controls for DR-1 & 2 size machines, there is a resistor of approximately six ohms in series with the lead to the starting winding. Earliest resistors were wire wound, blue enameled ones. Shortly before the DR-1-B and DR-2-F machines were introduced a change was made to copper-oxide resistors. Copper-oxide has a negative co-efficient of resistance; that is, its resistance decreases the warmer it gets. The purpose was to reduce the initial surge of starting current by having a relatively high initial resistance which decreased rapidly as the resistor warmed up. In the controls for DR-1-B machines, the resistor was changed to a wire-wound one a few months after production started, but in the controls

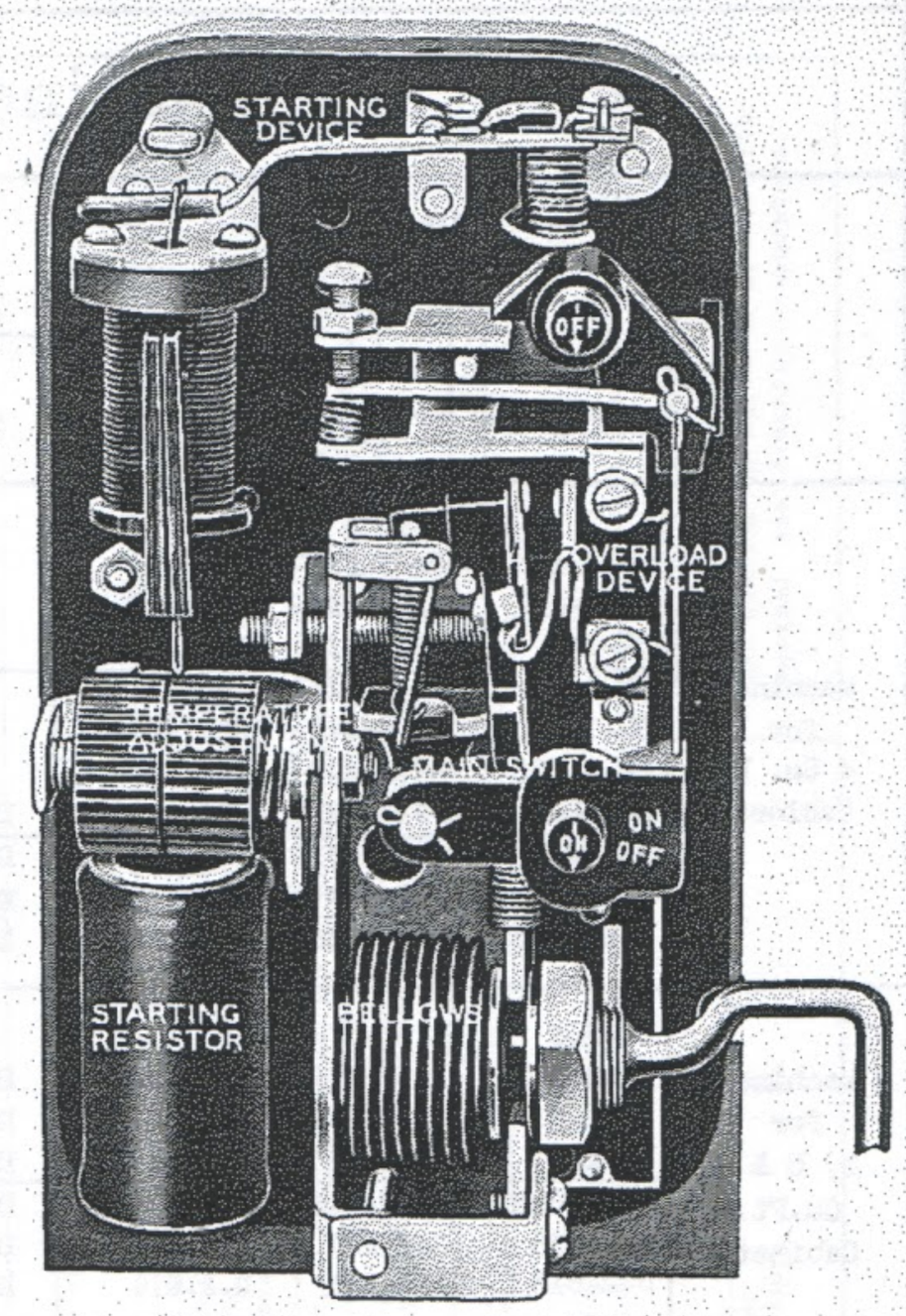


Fig. 10 Type "C" Control

for D-2-A machines, the copper-oxide resistor remained standard.

Nomenclature for Type DR Machines

NOMENCLATURE INSTRUCTIONS

To be uniform on nomenclature for rebuilt Type "DR" refrigerating machines and to be in line with present General Electric practice in nomenclature on new machines, it was necessary to add a new series of form numbers. In the following tabulation are listed the Original, Rebuilt *former* and New nomenclature.

The form letters used in the Original Nomenclature not only designated the various forms of machines but also indicated the voltage and frequency. For example, a DR-2-D is a form "D" machine for 110 volts 60 cycles and a DR-2-DD machine is for 115 volts direct current. Under our present nomenclature instructions, the form letters are followed by form numerals consisting of one or two digits to indicate power supply as follows.

(First Digit)	Indicating voltage
1	110 volts a-c 115 volts d-c
2	220 volts a-c 230 volts d-c

(Second digit)	Indicating frequency
No numeral	direct current
2	25 cycles
4	40 cycles
5	50 cycles
6	60 cycles

Examples: Type DR-2-R2 230 volt d-c
R16 110 volt 60 cycles
R12 110 volt 25 cycles

The rebuilt *former* nomenclature was used during the transition period when the original nomenclature was being correlated into the new and final nomenclature. It should be noted that in some cases, there is a duplication of the original nomenclature, but the machines are for different voltages. For example: The original DR-2-D2 machine was for 25 cycles, whereas under the rebuilt *former* nomenclature, this machine would be for 220 volts direct current. In the new nomenclature this condition has been corrected by assigning new form numbers on the rebuilt machines as in the above example where the "R" form number is used making a DR-2-R12 machine.

Machine Nomenclature

	110 Volts 50-60 Cycle Nomenclature			110 Volts 25 Cycle Nomenclature			115 Volts DC Nomenclature		
	Original	Rebuilt		Original	Rebuilt		Original	Rebuilt	
		Former	**New**		*Former*	**New**		*Former*	**New**
Machines for 4 Cu. Ft. Cabinets	DA-1-L1	*DA-1-L1*	**DA-1-L1**	-	-	-	-	-	-
	DA-1-L2	*DA-1-L2*	**DA-1-L2**	-	-	-	-	-	-
	DR-1-A	*DR-1-A16*	**DR-1-C16**	-	-	-	DR-1-AD	*DR-1-A1*	**DR-1-C1**
	DR-1-B	*DR-1-B16*	**DR-1-D16**	-	-	-	DR-1-BD	*DR-1-B1*	**DR-1-D1**
	DR-1-E16	*DR-1-E16*	**DR-1-E16**	-	-	-	DR-1-E1	*DR-1-E1*	**DR-1-E1**
	DR-1-F16	*DR-1-F16*	**DR-1-F16**	-	-	-	DR-1-F1	*DR-1-F1*	**DR-1-F1**
	DRA-2-A16	*DRA-2-A16*	**DRA-2-A16**	DRA-2-A12	*DRA-2-A12*	**DRA-2-A12**	DRA-2-A1	*DRA-2-A1*	**DRA-2-A1**
	DRA-2-D	*DRA-2-D16*	**DRA-2-D16**	DRA-2-D2	*DRA-2-D12*	**DRA-2-D12**	DRA-2-DD	*DRA-2-D1*	**DRA-2-D1**
	DRA-2-E	*DRA-2-E16*	**DRA-2-E16**	DRA-2-E2	*DRA-2-E12*	**DRA-2-E12**	DRA-2-ED	*DRA-2-E1*	**DRA-2-E1**
	D-15-A156	*D-15-A16*	**D-15-A16**	D-15-A12	*D-15-A12*	**D-15-A12**	-	-	-
Machines for 5, 6 & 7 Cu.Ft. Cabinets	DR-2-C	-	-	-	-	-	-	-	-
	DR-2-D	*DR-2-D16*	**DR-2-R16**	DR-2-D2	*DR-2-D12*	**DR-2-R12**	DR-2-DD	*DR-2-D1*	**DR-2-R1**
	DR-2-E	*DR-2-E16*	**DR-2-S16**	DR-2-E2	*DR-2-E12*	**DR-2-S12**	DR-2-ED	*DR-2-E1*	**DR-2-S1**
	DR-2-F	*DR-2-F16*	**DR-2-T16**	DR-2-F2	*DR-2-F12*	**DR-2-T12**	DR-2-FD	*DR-2-F1*	**DR-2-T1**
	DR-2-G16	*DR-2-G16*	**DR-2-G16**	DR-2-G12	*DR-2-G12*	**DR-2-G12**	DR-2-G1	*DR-2-G1*	**DR-2-G1**
	D-2-A16	*D-2-A16*	**D-2-A16**	D-2-A12	*D-2-A12*	**D-2-A12**	D-2-A1	*D-2-A1*	**D-2-A1**
	D-2-B16	*D-2-B16*	**D-2-B16**	D-2-B12	*D-2-B12*	**D-2-B12**	D-2-B1	*D-2-B1*	**D-2-B1**
Machines for 7,8, & 9 Cu. Ft. Cabinets	DRB-3-L1	*DRB-3-16*	**DRB-3-A16**	DRB-3-J1	*DRB-3-12*	**DRB-3-A12**	DRB-3-M1	*DRB-3-1*	**DRB-3-A1**
	DRB-3-L2	*DRB-3-16*	**DRB-3-A16**	DRB-3-J2	*DRB-3-12*	**DRB-3-A12**	DRB-3-M2	*DRB-3-1*	**DRB-3-A1**
	DRB-31-A16	*DRB-31-A16*	**DRB-31-A16**	DRB-31-A12	*DRB-31-A12*	**DRB-31-A12**	DRB-31-A1	*DRB-31-A1*	**DRB-31-A1**
	DRB-31-B16	*DRB-31-B16*	**DRB-31-B16**	DRB-31-B12	*DRB-31-B12*	**DRB-31-B12**	DRB-31-B1	*DRB-31-B1*	**DRB-31-B1**
	D-31-A16	*D-31-A16*	**D-31-A16**	D-31-A12	*D-31-A12*	**D-31-A12**	D-31-A1	*D-31-A1*	**D-31-A1**
	D-31-B16	*D-31-B16*	**D-31-B16**	D-31-B12	*D-31-B12*	**D-31-B12**	D-31-B1	*D-31-B1*	**D-31-B1**
	D-30-A16	*D-30-A16*	**D-30-A16**	D-30-A12	*D-30-A12*	**D-30-A12**	D-30-A1	*D-30-A1*	**D-30-A1**
	D-30-B16	*D-30-B16*	**D-30-B16**	D-30-B12	*D-30-B12*	**D-30-B12**	D-30-B1	*D-30-B1*	**D-30-B1**
	D-30-D16	*D-30-D16*	**D-30-D16**	D-30-D12	*D-30-D12*	**D-30-D12**	D-30-D1	*D-30-D1*	**D-30-D1**
	D-30-E16	*D-30-E16*	**D-30-E16**	D-30-E12	*D-30-E12*	**D-30-E12**	D-30-E1	*D-30-E1*	**D-30-E1**
	D-30-F16	*D-30-F16*	**D-30-F16**	D-30-F12	*D-30-F12*	**D-30-F12**	D-30-F1	*D-30-F1*	**D-30-F1**
	D-30-G16	*D-30-G16*	**D-30-G16**	D-30-G12	*D-30-G12*	**D-30-G12**	D-30-G1	*D-30-G1*	**D-30-G1**
	D-30-H16	*D-30-H16*	**D-30-H16**	D-30-H12	*D-30-H12*	**D-30-H12**	D-30-H1	*D-30-H1*	**D-30-H1**
Machines for 9, 10, 14 & 17 Cu.Ft. Cabinets	DR-3C	-	-	-	-	-	DR-3-CD	-	-
	DR-3-D	*DR-3-16*	**DR-3-R1**	-	-	-	DR-3-DD	*DR-3-1*	**DR-3-R1**
	DR-3-D1	*DR-3-16*	**DR-3-R16**	DR-3-F	*DR-3-12*	**DR-3-R12**	DR-3-DD1	*DR-3-1*	**DR-3-R1**
	DR-3-E	*DR-3-16*	**DR-3-R16**	DR-3-G	*DR-3-12*	**DR-3-R12**	DR-3-ED	*DR-3-1*	**DR-3-R1**
	DR-3-L1	*DR-3-16*	**DR-3-R16**	DR-3-J1	*DR-3-12*	**DR-3-R12**	DR-3-M1	*DR-3-1*	**DR-3-R1**
	DR-3-L2	*DR-3-16*	**DR-3-S16**	DR-3-J2	*DR-3-12*	**DR-3-S12**	DR-3-M2	*DR-3-1*	**DR-3-S1**
	DRE-3-L1	*DRE-3-16*	**DRE-3-A16**	DRE-3-J1	*DRE-3-12*	**DRE-3-A12**	DRE-3-M1	*DRE-3-1*	**DRE-3-A1**
	DRE-3-L2	*DRE-3-16*	**DRE-3-B16**	DRE-3-J2	*DRE-3-12*	**DRE-3-B12**	DRE-3-M2	*DRE-3-1*	**DRE-3-B1**
Machines for 9, 10, 14 & 17 Cu.Ft. Cabinets	DR-35-A16	*DR-35-A16*	**DR-35-A16**	DR-35-A12	*DR-35-A12*	**DR-35-A12**	DR-35-A1	*DR-35-A1*	**DR-35-A1**
	DR-35-B16	*DR-35-B16*	**DR-35-B16**	DR-35-B12	*DR-35-B12*	**DR-35-B12**	DR-35-B1	*DR-35-B1*	**DR-35-B1**
	D-35-A16	*D-35-A16*	**D-35-A16**	D-35-A12	*D-35-A12*	**D-35-A12**	D-35-A1	*D-35-A1*	**D-35-A1**
	D-35-B16	*D-35-B16*	**D-35-B16**	D-35-B12	*D-35-B12*	**D-35-B12**	D-35-B1	*D-35-B1*	**D-35-B1**
	DRA-4-L1	*DRA-4-16*	**DRA-4-A16**	DRA-4-J1	*DRA-4-12*	**DRA-4-A12**	DRA-4-M1	*DRA-4-1*	**DRA-4-A1**
	DRE-4-L1	*DRE-4-16*	**DRE-4-A16**	DRE-4-J1	*DRE-4-12*	**DRE-4-A12**	DRE-4-M1	*DRE-4-1*	**DRE-4-A1**
	D-40-A16	*D-40-A16*	**D-40-A16**	D-40-A12	*D-40-A12*	**D-40-A12**	D-40-A1	*D-40-A1*	**D-40-A1**
	D-40-B16	*D-40-B16*	**D-40-B16**	D-40-B12	*D-40-B12*	**D-40-B12**	D-40-B1	*D-40-B1*	**D-40-B1**
	D-40-C16	*D-40-C16*	**D-40-C16**	D-40-C12	*D-40-C12*	**D-40-C12**	D-40-C1	*D-40-C1*	**D-40-C1**
	D-40-D16	*D-40-D16*	**D-40-D16**	D-40-D12	*D-4C-D12*	**D-40-D12**	D-40-D1	*D-40-D1*	**D-40-D1**
	D-40-E16	*D-40-E16*	**D-40-E16**	D-40-E12	*D-40-E12*	**D-40-E12**	D-40-E1	*D-40-E1*	**D-40-E1**
	D-40-A15	*D-40-A15*	**D-40-A15**	-	-	-	-	-	-
	DRA-4-V1	*DRA-4-15*	**DRA-4-A15**	-	-	-	-	-	-

Machine Nomenclature

(Continued)

230 Volts DC Nomenclature			REMARKS
Original	Rebuilt		
	Former	New	
-	-	-	Model SD-35 or SD-40 with machine attached permanently left side of cabinet; right hand door only on cabinet; type "E" or "D" control
-	-	-	Model SD-35 or SD-40 with machine attached permanently right side of cabinet; right hand door only on cabinet; type "E" or "D" control
DR-1-AC	*DR-1-A2*	DR-1-C2	Open-oval type porcelain evaporator; type "D" control
DR-1-BC	*DR-1-B2*	DR-1-D2	Similar to DR-1-A except with wider & flatter evaporator; type "E" control
DR-1-E2	*DR-1-E2*	DR-1-E2	Rebuilt DR-1-B; CK-1 stainless steel evaporator; type "E" control
DR-1-F2	*DR-1-F2*	DR-1-F2	Rebuilt DR-1-A; CK-1 stainless steel evaporator; type "D" control
-	-	-	Rebuilt machine; equipped with DR-1-B open type porcelain evaporator; special DRA-2 cabinet top; 32 or 64 fin condenser, DR-2 size compressor; type "C" control
-	-	-	Short oven type porcelain evaporator; special DRA-2 cabinet top; 32 or 64 fin condenser; type "A" or "C" control; DR-1 size compressor; Sun Oil, or potassium carbonate freezing solution
-	-	-	Rebuilt machine; similar to DRA-2-D but with only 32 fin condenser; type "C" control
-	-	-	DR-1-B evaporator; D-2 compressor; inverted fin condenser; DR-2 size cabinet top; type "E" control
-	-	-	Oven type porcelain evaporator; 64 fin condenser; short stroke - 0.625 inches; type "A" control; no oil conditioner; glycerine freezing solution
DR-2-DC	*DR-2-D2*	DR-2-R2	Oven type porcelain evaporator; 64 fin condenser; type "A" or "C" control; glycerine, Sun Oil, or potassium carbonate freezing solution; no oil conditioner below serial 38,000
DR-2-EC	*DR-2-E2*	DR-2-S2	Oven type porcelain evaporator; 32 fin condenser; type "C" control; glycerine, Sun Oil, or potassium carbonate freezing solution
DR-2-FC	*DR-2-F2*	DR-2-T2	Open type porcelain evaporator; 32 or 64 fin condenser; type "E" control
DR-2-G2	*DR-2-G2*	DR-2-H2	Rebuilt DR-2, D, E, or F machine equipped with CK-2 stainless steel evaporator; 32 or 64 fin condenser; type "C" or "E" control
D-2-A2	*D-2-A2*	D-2-A2	Open type porcelain evaporator; inverted fin condenser; type "E" control
D-2-B2	*D-2-B2*	D-2-B2	Rebuilt machine; similar to D-2-A, but equipped with CK-2 stainless steel evaporator
DRB-3-P1	*DRB-3-2*	DRB-3-A2	Oven type porcelain evaporator; 80 fin condenser, type "C" control; DR-3 size compressor
DRB-3-P2	*DRB-3-2*	DRB-3-A2	Oven type porcelain evaporator; 40 fin condenser, type "C" control; DR-3 size compressor
DRB-31-A2	*DRB-31-A2*	DRB-31-A2	Open type porcelain evaporator with aluminum shelf; 40 or 80 fin condenser, type "E" control, bolted compressor case
DRB-31-B2	*DRB-31-B2*	DRB-31-B2	Rebuilt machine; similar to DRB-31-A but equipped with CB-3 stainless steel evaporator
D-31-A2	*D-31-A2*	D-31-A2	Similar to DRB-31-A, but with welded compressor case
D-31-B2	*D-31-B2*	D-31-B2	Rebuilt machine, similar to D-31-A but equipped with CB-3 stainless steel evaporator
D-30-A2	*D-30-A2*	D-30-A2	Single large oven-type porcelain evaporator; 40 fin condenser; type "E" control; welded compressor case; potassium carbonate freezing solution
D-30-B2	*D-30-B2*	D-30-B2	Similar to D-30-A, but with inverted fin condenser
D-30-D2	*D-30-D2*	D-30-D2	Rebuilt machine, similar to D-31-B
D-30-E2	*D-30-E2*	D-30-E2	Rebuilt machine; similar to D-30-A but equipped with the CB-3 stainless steel evaporator
D-30-F2	*D-30-F2*	D-30-F2	Rebuilt DRB-3-A, or DRB-31-B machines equipped with the CB-3 stainless steel evaporator; 40 or 80 fin condenser; type "E" control; bolted compressor case
D-30-G2	*D-30-G2*	D-30-G2	Rebuilt DRB-3-A, or DRB-31-A or B machines equipped with CK-2 stainless steel evaporator; 40 or 80 fin condenser; type "C" control; bolted compressor case
D-30-H2	*D-30-H2*	D-30-H2	Rebuilt D-30-A, B, or E machine equipped with a CK-2 stainless steel evaporator; inverted or 40 fin condenser; type "E" control, welded compressor case
-	-	-	Two oven type porcelain evaporators; 80 fin condenser; type "A" control; bolted type compressor case; glycerine, Sun Oil, or potassium carbonate freezing solution; no oil conditioner
-	-	-	Two oven type porcelain evaporators; 80 fin condenser; type "A" or "C" control; bolted type compressor case; glycerine, Sun Oil or potassium carbonate freezing solution; no oil conditioner
-	-	-	Two oven type porcelain evaporators, 80 fin condensers, type "A" or "C" control; bolted type compressor case; glycerine, Sun Oil, or potassium carbonate freezing solution
DR-3-ED1	*DR-3-2*	DR-3-R2	Similar to DR-3-D machine, but with oil conditioner, and line welded compressor case
DR-3-P1	*DR-3-2*	DR-3-R2	Two oven type porcelain evaporators, 80 fin condenser, type "C" control; bolted compressor case, glycerine, Sun Oil, or potassium carbonate freezing solution
DR-3-P2	*DR-3-2*	DR-3-S2	Similar to DR-3-L1, but with 40 fin condenser
DRE-3-P1	*DRE-3-2*	DRE-3-A2	Similar to DR-3-L2, but equipped with two square oven type porcelain evaporators with shelf; 80 fin condenser, type "C" or "E" control
DRE-3-P2	*DRE-3-2*	DRE-3-B2	Similar to DRE-3-L1, but with 40 fin condenser
DR-35-A2	*DR-35-A2*	DR-35-A2	Similar to DRE-3-L1 or L2, but with porcelain shelf removed from right-hand oven evaporator; 40 or 80 fin condenser
DR-35-B2	*DR-35-B2*	DR-35-B2	Rebuilt DRE-3-L1 or L2, or DR-35-A machine, equipped with two CB-2 stainless steel evaporators
D-35-A2	*D-35-A2*	D-35-A2	Similar to DR-35-A but with welded compressor case
D-35-B2	*D-35-B2*	D-35-B2	Rebuilt D-35-A machine; equipped with two CB-2 stainless steel evaporators; limited quantity have inverted fin condenser
DRA-4-P1	*DRA-4-2*	DRA-4-A2	Two oven type porcelain evaporators; type "C" control
DRE-4-P1	*DRE-4-2*	DRE-4-A2	Similar to DRA-4-L1 but equipped with two square oven type evaporators with shelf
D-40-A2	*D-40-A2*	D-40-A2	Similar to DRE-4-L1 but with porcelain shelf removed from right-hand oven evaporator
D-40-B2	*D-40-B2*	D-40-B2	Similar to D-40-A, but with collar around compressor case weld
D-40-C2	*D-40-C2*	D-40-C2	Similar to D-40-A, but with collar around compressor case weld
D-40-D2	*D-40-D2*	D-40-D2	Similar to D-40-A, but with collar around compressor case weld; type 3 size liquid filled capacitor
D-40-E2	*D-40-E2*	D-40-E2	Rebuilt DRA-4-L1, DRE-4-L1, D-40-A,B,C,& D machines equipped with two CB-2 stainless steel evaporators
-	-	-	Same as D-40-A16, but for 50 cycle operation
-	-	-	Same as DRA-4-L1, but for 50 cycle operation

There are a few Type D-43-A refrigerating machines in service which are similar to the D-40-A, but with special ice freezing evaporators.

Specifications

DR-1 SIZE MACHINES

Machines	Original – / Rebuilt New –	DA-1-L1 & L2 / DA-1-L1 & L2	DR-1-A16 / DR-1-C16	DR-1-B16 / DR-1-D16	DR-1-E16 / DR-1-E16	DR-1-F16 / DR-1-F16	D-15-A156 / D-15-A16
Motor Data							
Rated Voltage		110	110	110	110	110	110
Rated Cycles		60	60	60	60	60	60
Speed (Full Load) RPM		1740	1740	1740	1740	1740	1740
‡Watts (Average 80 F Performance)		145	140	145	150	150	160
Amperes (Average 80 F Performance)		2.3	2.25	2.3	2.4	2.4	2.5
Starting Current, Amperes (Locked Rotor)		16	16	16	16	16	18
Rated Horsepower		1/10	1/10	1/10	1/10	1/10	1/8
Compressor Data							
Number of Pistons		1	1	1	1	1	1
Piston Stroke (Inches)		0.55	0.55	0.55	0.55	0.55	0.70
Piston Bore (Inches)		1.00	1.00	1.00	1.00	1.00	1.00
Miscellaneous							
Capacity Btu/hr 100 F Room, 20 F Evaporator		320	250	330	340	340	370
Control CR-1050 Type		D or E	D	E	E	D	E
Control Temperature Range Mid Position °F		⊕29-14	29-14	29-14	29-14	29-14	29-14
Evaporator Temperature, Control Mid Position F		24-15	24-15	24-15	20-9	20-9	24-15
Refrigerant Charge SO_2 Pounds (Recommended)		3.7	3.5	3.75	2.0	2.0	4
Weight of Machine Uncrated Pounds (Approx.)		*275	140	135	130	130	165

DR-2 SIZE MACHINES

Machines	Original – / Rebuilt New –	DRA-2-A16 / DRA-2-A16	DRA-2-D / DRA-2-D16	DRA-2-E / DRA-2-E16	DR-2-C / -	DR-2-D / DR-2-R16	DR-2-E / DR-2-S16	DR-2-F / DR-2-T16	DR-2-G16 / DR-2-G16	D-2-A16 / D-2-A16	D-2-B16 / D-2-B16
Motor Data											
Rated Voltage		110	110	110	110	110	110	110	110	110	110
Rated Cycles		60	60	60	60	60	60	60	60	60	60
Speed (Full Load) RPM		1740	1740	1740	1740	1740	1740	1740	1740	1740	1740
‡Watts (Average 80 F Performance)		160	155	155	150	160	160	175	175	180	180
Amperes (Average 80 F Performance)		2.6	2.5	2.5	2.4	2.5	2.6	2.7	2.7	2.75	2.75
Starting Current Amperes (Locked Rotor)		18	18	18	18	18	18	18	18	18	18
Rated Horsepower		1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
Compressor Data											
Number of Pistons		1	1	1	1	1	1	1	1	1	1
Piston Stroke (Inches)		0.70	0.70	0.70	.625	0.70	0.70	0.70	0.70	0.70	0.70
Piston Bore (Inches)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Miscellaneous											
Capacity Btu/hr 100 F Room, 20 F Evaporator		360	325	320	300	350	340	385	400	440	450
Control CR-1050 Type		C	A or C	C	A	A or C	C	E	C or E	E	E
Control Temperature Range Mid Position °F		29-14	23-11	23-11	23-11	23-11	23-11	⊕29-14	29-14	29-14	29-14
Evaporator Temperature, Control Mid Position °F		24-15	†21-7	†21-7	21-5	†21-7	†21-7	22-12	25-17	26-18	25-17
Refrigerant Charge SO_2 Pounds (Recommended)		4	6	6	6.75	6.75	6.75	5.5	2.2	5.75	2.2
Freezing Solution, Pt. (40% Potassium Carbonate)		-	5	5	5.5	5.5	5.5	-	-	-	-
Weight of Machine Uncrated Pounds (Approx.)		190	200	195	220	220	200	180	190	170	180

‡ Average watts 50 to 60 percent higher for direct current machines.

⊕ Early production control limit 29-14; late production 23-11, Evaporator 17-5.

* Used in cabinets Model SD-35 and SD-40 permanently attached.

† For machines with 20% Glycerine 21-5; Sun Oil 22-2.

NOTE: The limits given in the specification tables for the control and evaporator temperature ranges are by necessity approximate and therefore should be used only as a guide. The use of steel bridle springs, as in reconditioned machines, raises the cut-on and lowers the cut-off temperatures by about two degrees.

MACHINE SPECIFICATIONS

In the following tabulations are given the specifications for the various Type "DR" refrigerating machines. The motor data are given for the standard 110 volt 60 cycle machines. Power and current consumption for machines operated on direct current or frequencies other than 60 cycles will vary somewhat from the values given in the tabulations.

Under the compressor data are given the capacity of the machines in British thermal units (Btu) per hour. The capacity is given for a definite ambient and evaporator temperatures. Variations in either one of these temperatures will cause variation in the capacity of the machine. An increase in the ambient temperature causes a decrease in capacity and an increase in the evaporator temperature causes an increase in capacity.

Specifications

DR-3 SIZE MACHINES

Machines	Original –	DRB-3-L1&L2	DRB-31-A16	DRB-31-B16	D-30-A&B16	D-30-D16	D-30-E&F16	D-30-G16	D-30-H16
	Rebuilt New –	DRB-3-A&B16	DRB-31-A16	DRB-31-B16	D-30-A&B16	D-30-D16	D-30-E&F16	D-30-G16	D-30-H16
Motor Data									
Rated Voltage		110	110	110	110	110	110	110	110
Rated Cycles		60	60	60	60	60	60	60	60
Speed (Full Load) RPM		1740	1740	1740	1740	1740	1740	1740	1740
‡Watts (Average 80 F Performance)		195	195	195	205	210	200	200	200
Amperes (Average 80 F Performance)		2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Starting current Amperes (Locked Rotor)		16	16.2	16.2	16.2	16.2	16.2	16.2	16.2
Rated Horsepower		1/6	1/6	1/6	1/6	1/6	1/6	1/6	1/6
Compressor Data									
Number of Pistons		1	1	1	1	1	1	1	1
Piston Stroke (Inches)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Piston Bore (Inches)		1-1/32	1-1/32	1-1/32	1-1/32	1-1/32	1-1/32	1-1/32	1-1/32
Miscellaneous									
Capacity Btu/hr (80F Room, 20F Evaporator)		550	650	650	660	660	660	670	670
Control CR-1050 Type		C	E	E	E	E	E	C	E
Control Temperature Range Mid Position °F		14-26	16-24	16-24	16-24	16-24	16-24	16-24	16-24
Refrigerant Charge SO_2 Pounds (Recommended)		7	6	4.2	4.5	4	4.25	2.5	2.5
Freezing Solution, Pt. (40% Potassium Carbonate)		5.5	-	-	18	-	-	-	-
Weight of Machine Uncrated Pounds (Approx.)		250	225	225	240	225	225	220	220

DR-3 SIZE MACHINES

Machines	Original –	D-31-A16	D-31-B16	DR-3-C,D,D1,E,L1 & L2	DRE-3-L1&L2	DR-35-A16	DR-35-B16	D-35-A16	D-35-B16
	Rebuilt New –	D-31-A16	D-31-B16	DR-3 - R16 & S16	DRE-3-A16&B16	DR-35-A16	DR-35-B16	D-35-A16	D-35-B16
Motor Data									
Rated Voltage		110	110	110	110	110	110	110	110
Rated Cycles		60	60	60	60	60	60	60	60
Speed (Full Load) RPM		1740	1740	1740	1740	1740	1740	1740	1740
‡Watts (Average 80 F Performance)		200	200	215	210	205	210	200	210
Amperes (Average 80 F Performance)		2.1	2.1	2.3	2.25	2.2	2.3	2.2	2.3
Starting current Amperes (Locked Rotor)		16	16	16	16	16	16	16	16
Rated Horsepower		1/6	1/6	1/6	1/6	1/6	1/6	1/6	1/6
Compressor Data									
Number of Pistons		1	1	1	1	1	1	1	1
Piston Stroke (Inches)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Piston Bore (Inches)		1-1/32	1-1/32	1-1/32	1-1/32	1-1/32	1-1/32	1-1/32	1-1/32
Miscellaneous									
Capacity Btu/hr (80F Room, 20F Evaporator)		650	650	670	680	690	700	690	700
Control CR-1050 Type		E	E	A or C	C or E	C or E	C or E	C or E	C or E
Control Temperature Range Mid Position °F		16-24	16-24	14-23	16-24	17-25	16-24	17-25	16-24
Refrigerant Charge SO_2 Pounds (Recommended)		6	4	13	6	5.75	8.25	5.75	8.25
Freezing Solution, Pt. (40% Potassium Carbonate)		-	-	11	18	18	-	18	-
Weight of Machine Uncrated Pounds (Approx.)		230	230	280	270	260	260	250	250

‡ Average watts 50 to 60 per cent higher for direct current machines.

Specifications

DR-4 SIZE MACHINES

Machines	Original –	D-40-A16	D-40-B-C-& D16	D-40-E16	DRE-4-L1	DRA-4-L1
	Rebuilt New –	**D-40-A16**	**D-40-B-C-& D16**	**D-40-E16**	**DRE-4-A16**	**DRA-4-A16**
Motor Data						
Rated Voltage		110	110	110	110	110
Rated Cycles		*60	*60	*60	60	60
Speed (Full Load) RPM		1740	1740	1740	1740	1740
‡Watts (Average 80 F Performance)		340	340	370	340	350
Amperes (Average 80 F Performance)		3.8	3.8	3.8	3.8	3.8
Starting Current, Amperes (Locked Rotor)		20	20	20	20	20
Rated Horsepower		1/3	1/3	1/3	1/3	1/3
Compressor Data						
Number of Pistons		2	2	2	2	2
Piston Stroke (Inches)		1.00	1.00	1.00	1.00	1.00
Piston Bore (Inches)		1-1/32	1-1/32	1-1/32	1-1/32	1-1/32
Miscellaneous						
Capacity Btu/hr (80 F Room, 20F Evaporator)		1200	1200	1200	1200	1200
Control CR-1050 Type		C	C	C	C	C
Control Temperature Range Mid-Position °F		15-25	15-25	15-25	15-25	15-25
Refrigerant Charge, Sulphur Dioxide, Pounds		7.5	7.5	9.75	7.75	14
Freezing Solution, Pints (40% Potassium Carbonate)		20	20	-	20	11
Weight of Machine, Pounds, Uncrated (Approx)		330	330	325	330	325

* Resistor Cat. No. 11X79 necessary for operation on 110 volt, 50 cycle power supply.

‡ Average watts 50 to 60 per cent higher for direct current machines.

Machine Identification

TYPE DR MACHINES

On the following pages are shown pictures of Type "DR" refrigerating machines. These pictures can be used as a guide in identifying the various machines. Rebuilt machines may have a later type of control or some other minor change which differs from the original machine. In some of the pictures the machines as shown have these changes as in the case where a Type "C" control is shown on the machine in the picture but the machine was manufactured with a Type "A" control.

The dimensions are given to aid in determining interchangeability and clearances of the various machines.

At the bottom of each picture is given respectively the original, rebuilt *former* and **new** nomenclature for that machine. The "original" nomenclature is shown in regular type, the rebuilt *"former"* is indicated in Italic, and the rebuilt "**new**" nomenclature is indicated in Bold Type. For further information on the machine nomenclature refer to the Nomenclature Tabulation given on page 7 which gives complete nomenclature and descriptive details of the various machines.

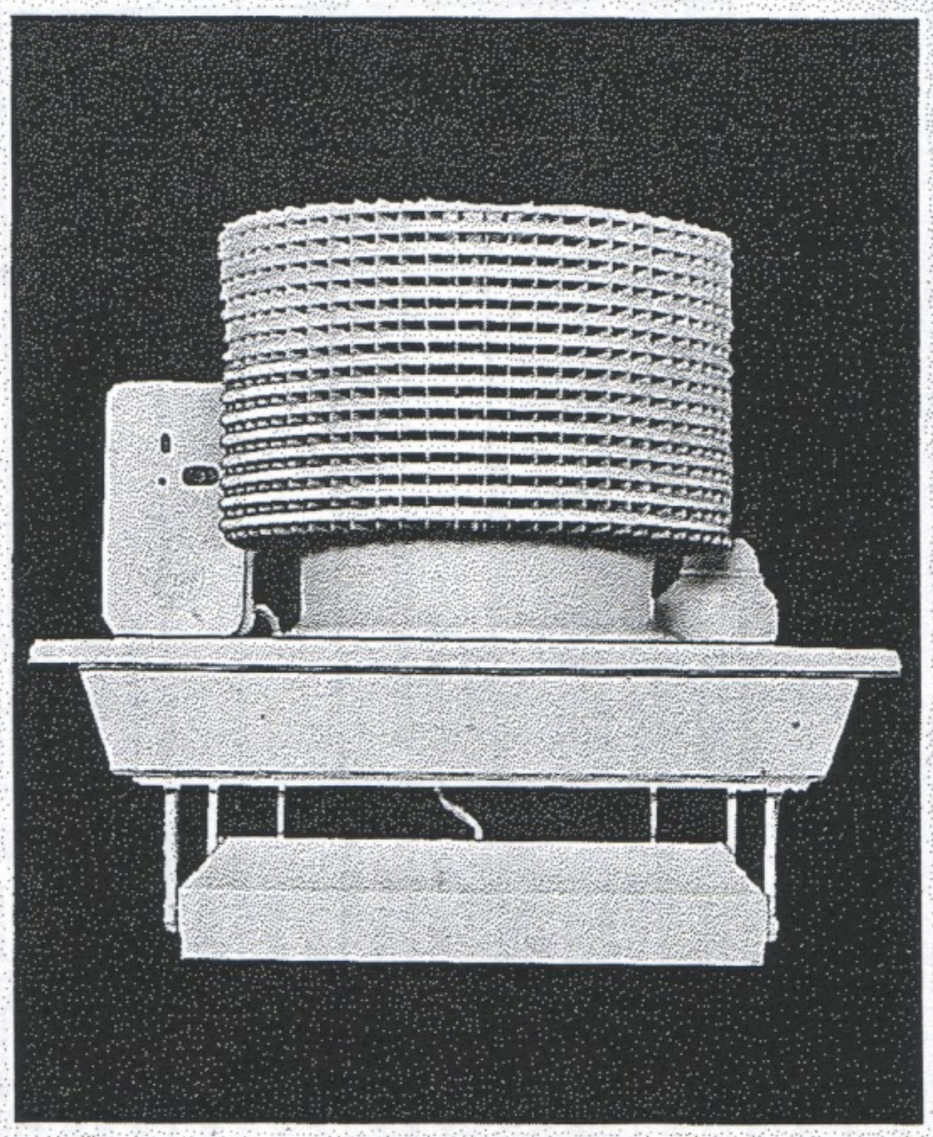


Fig. 11 DR-2-A

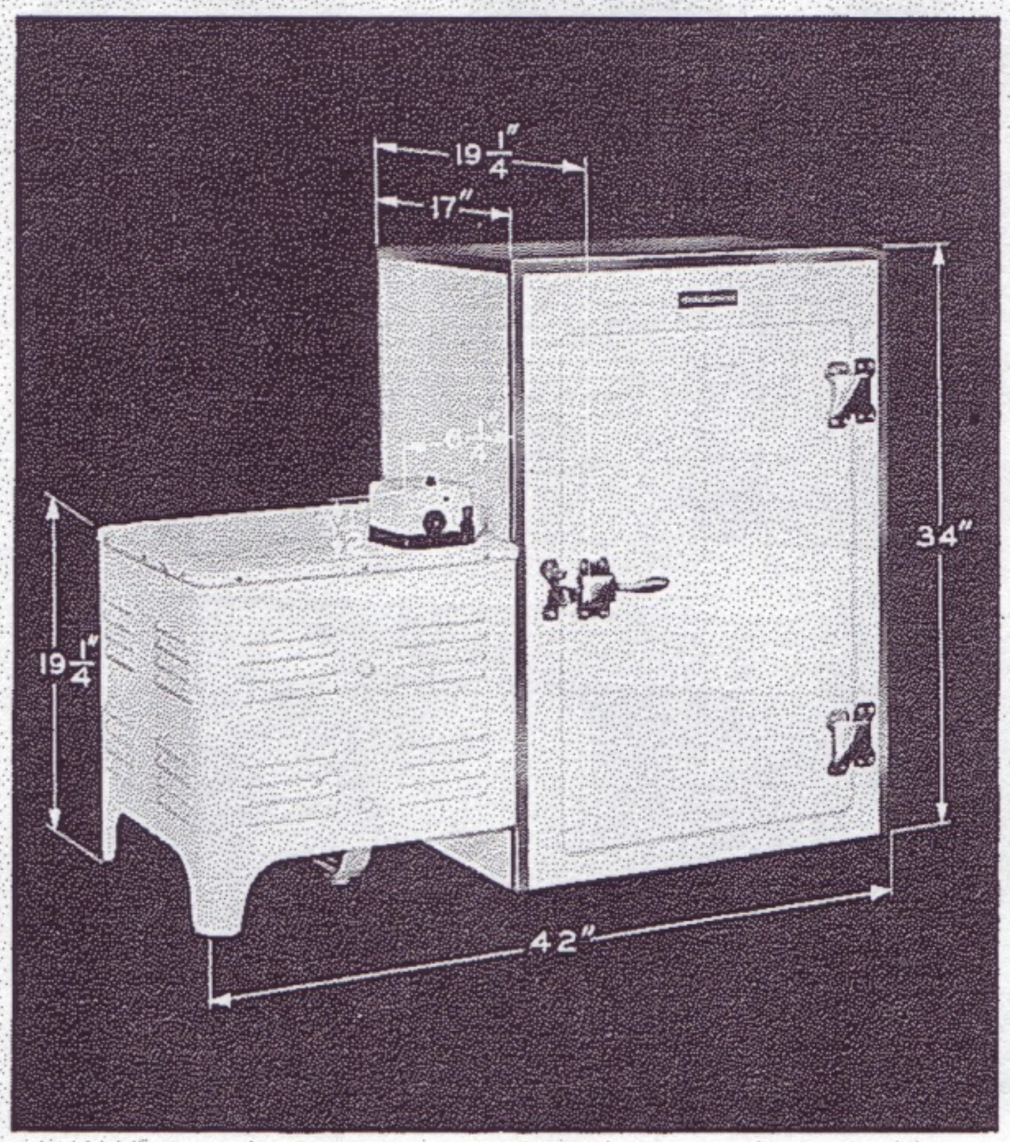


Fig. 12 DA-1-L1 *DA-1-L1* DA-1-L1

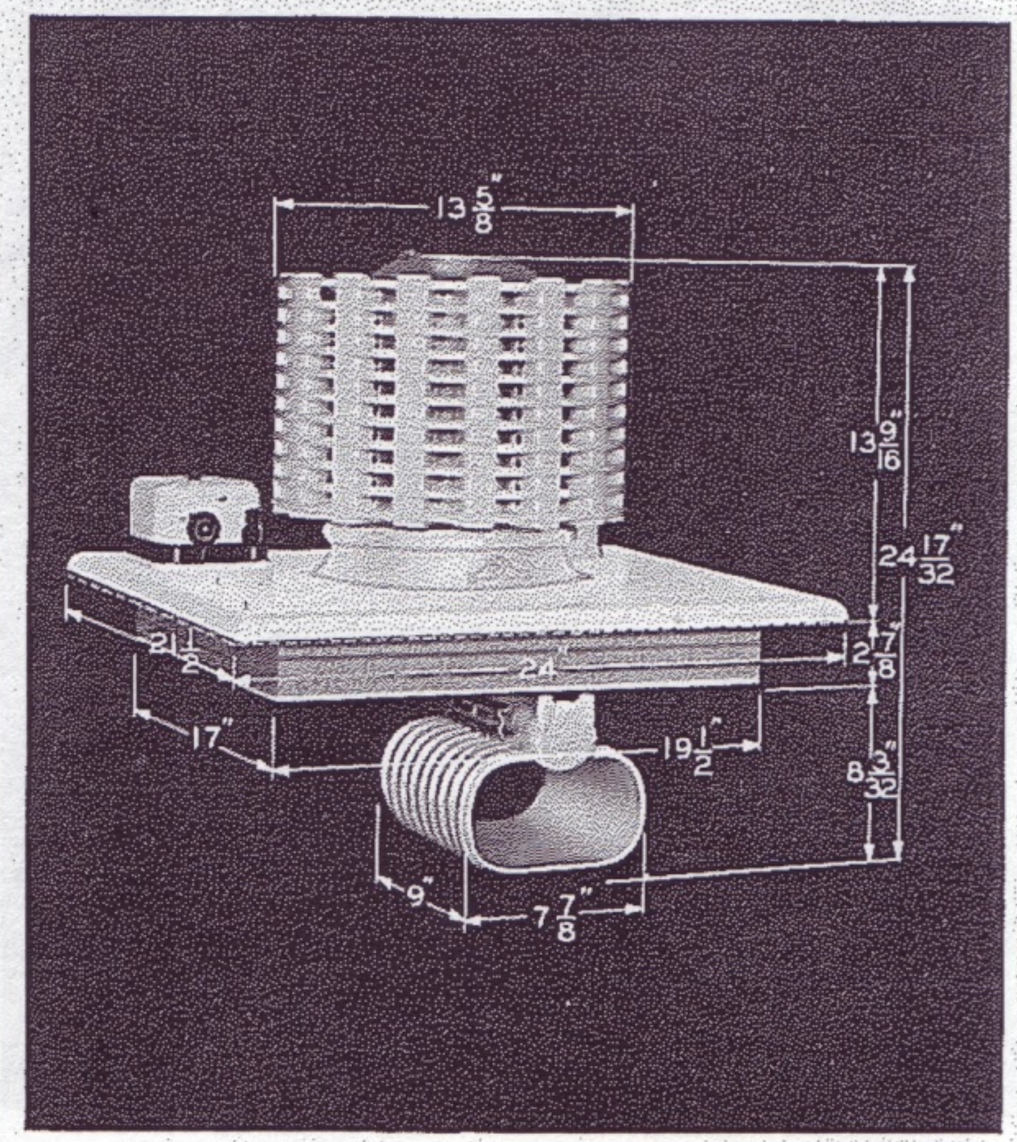


Fig. 13 DR-1-A *DR-1-A16* DR-1-C16

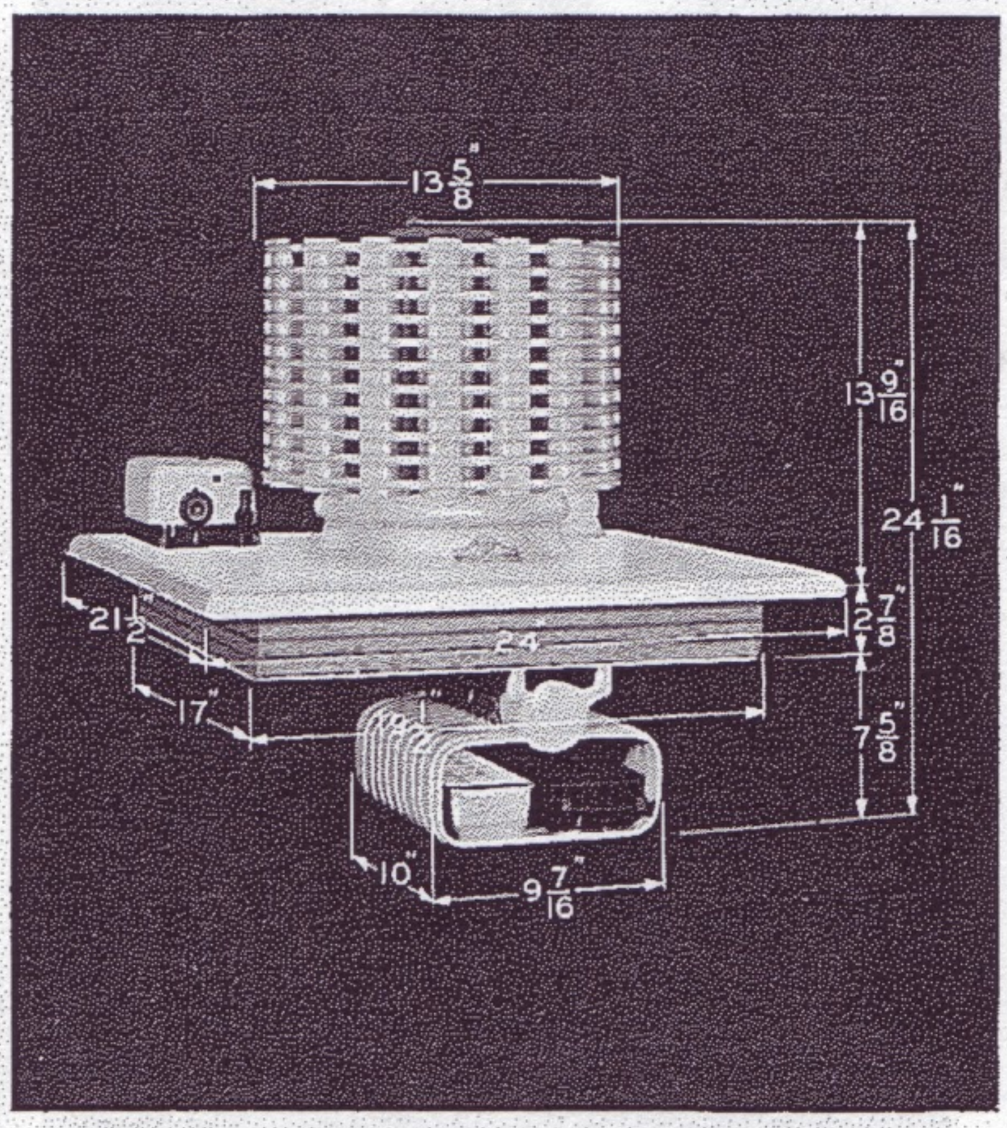


Fig. 14 DR-1-B *DR-1-B16* DR-1-D16

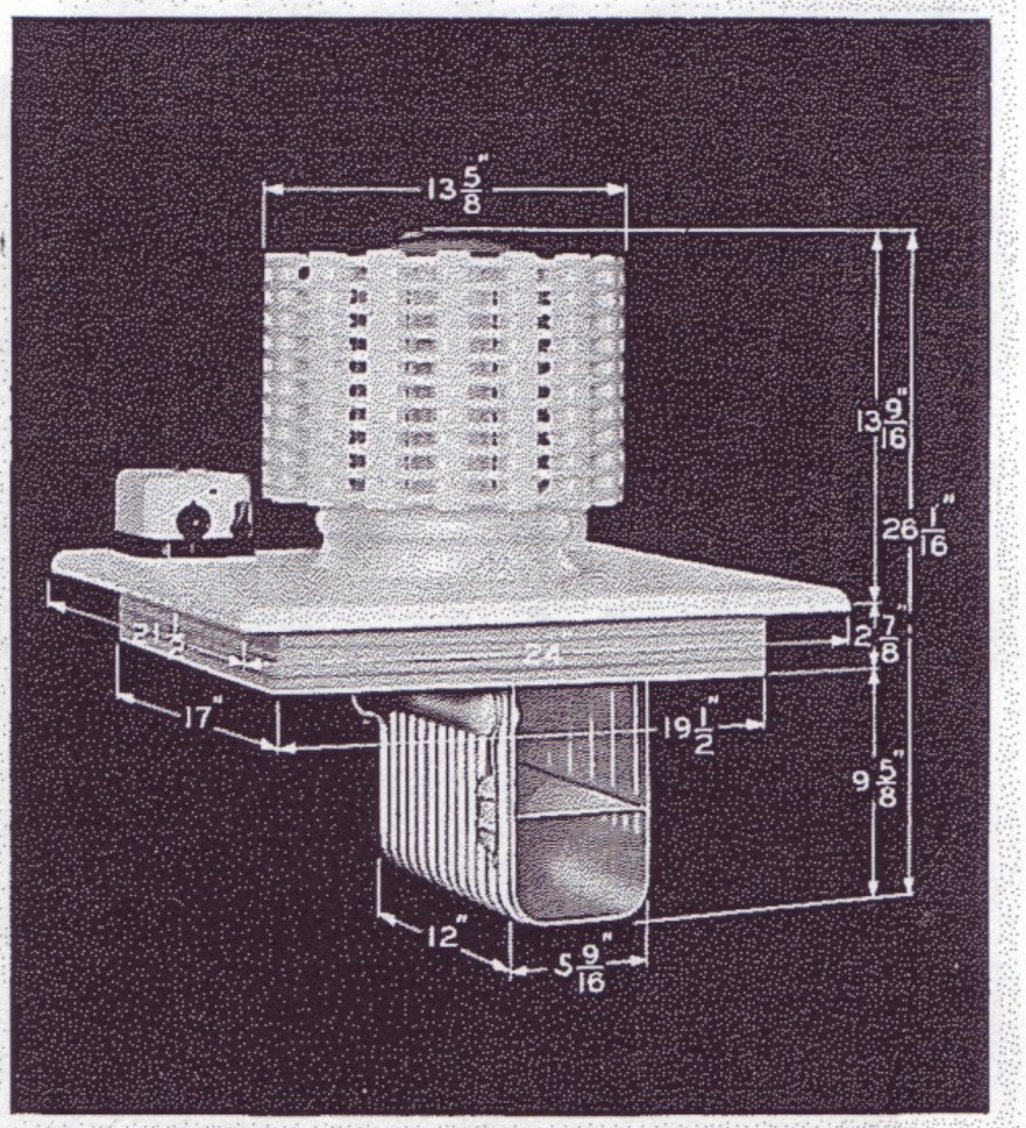


Fig. 15 DR-1-F *DR-1-F16* DR-1-F16
DR-1-E Same but with Type "D" control

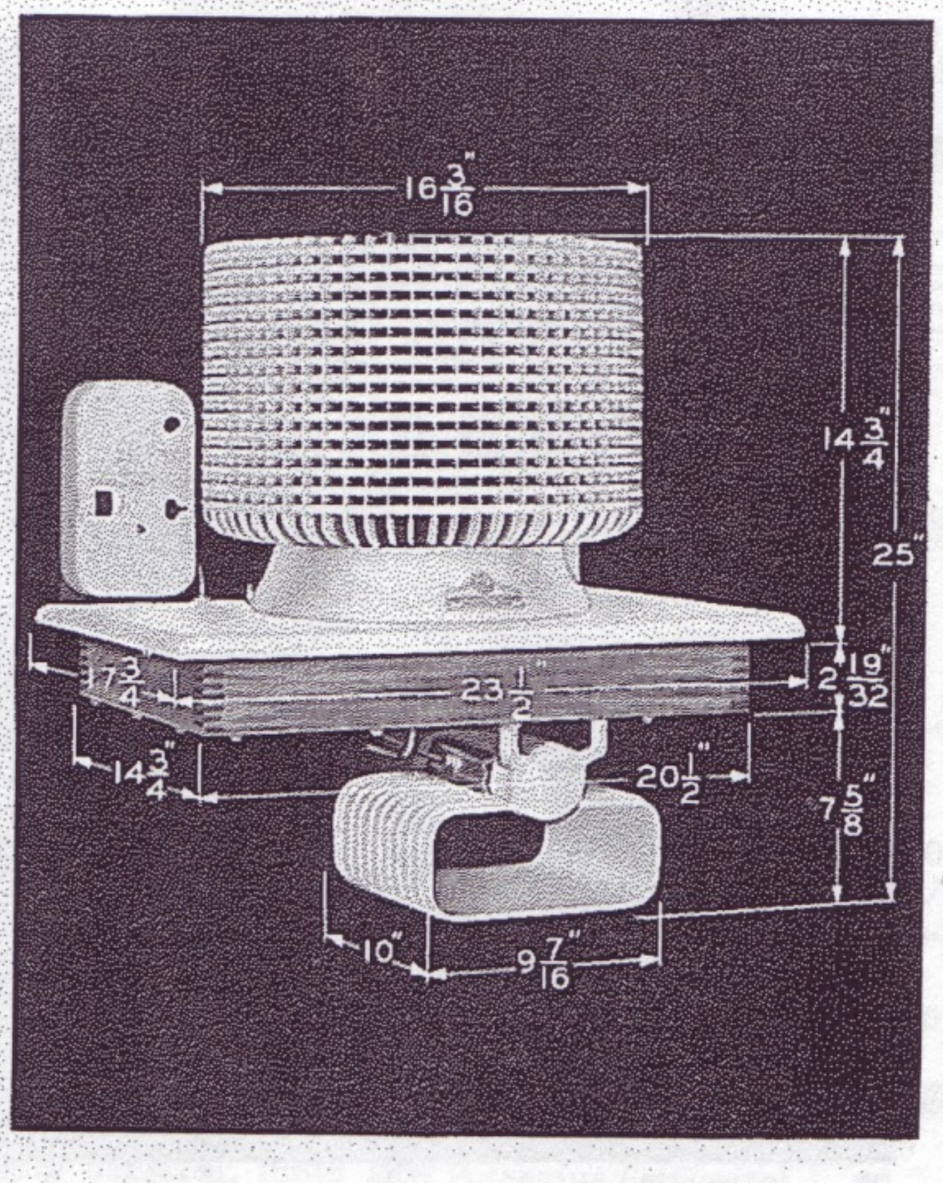


Fig. 16 DRA-2-A *DRA-2-A16* DRA-2-A16

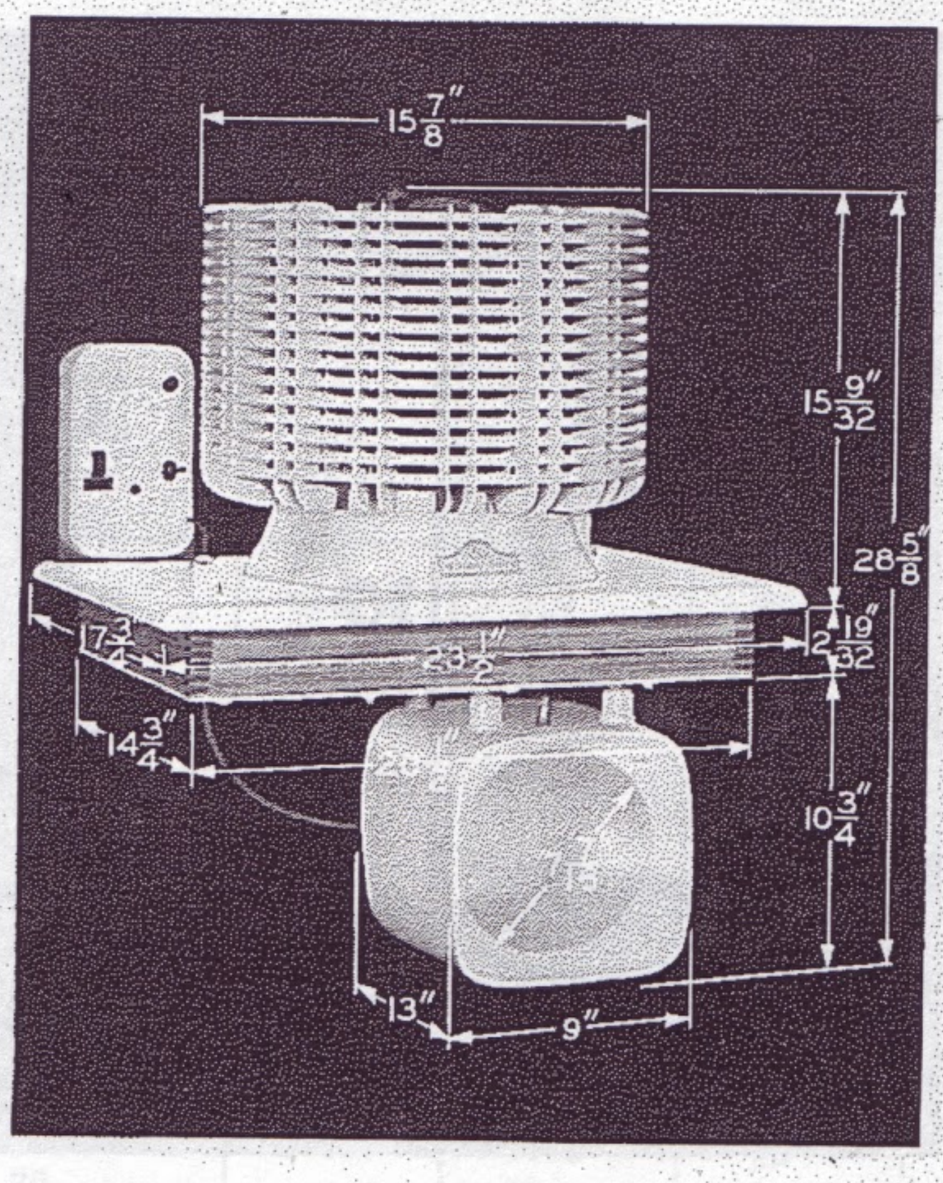


Fig. 17 DRA-2-E *DRA-2-E16* DRA-2-E16
DRA-2-D Same but with 32 or 64 fin condenser; Type A or C Control

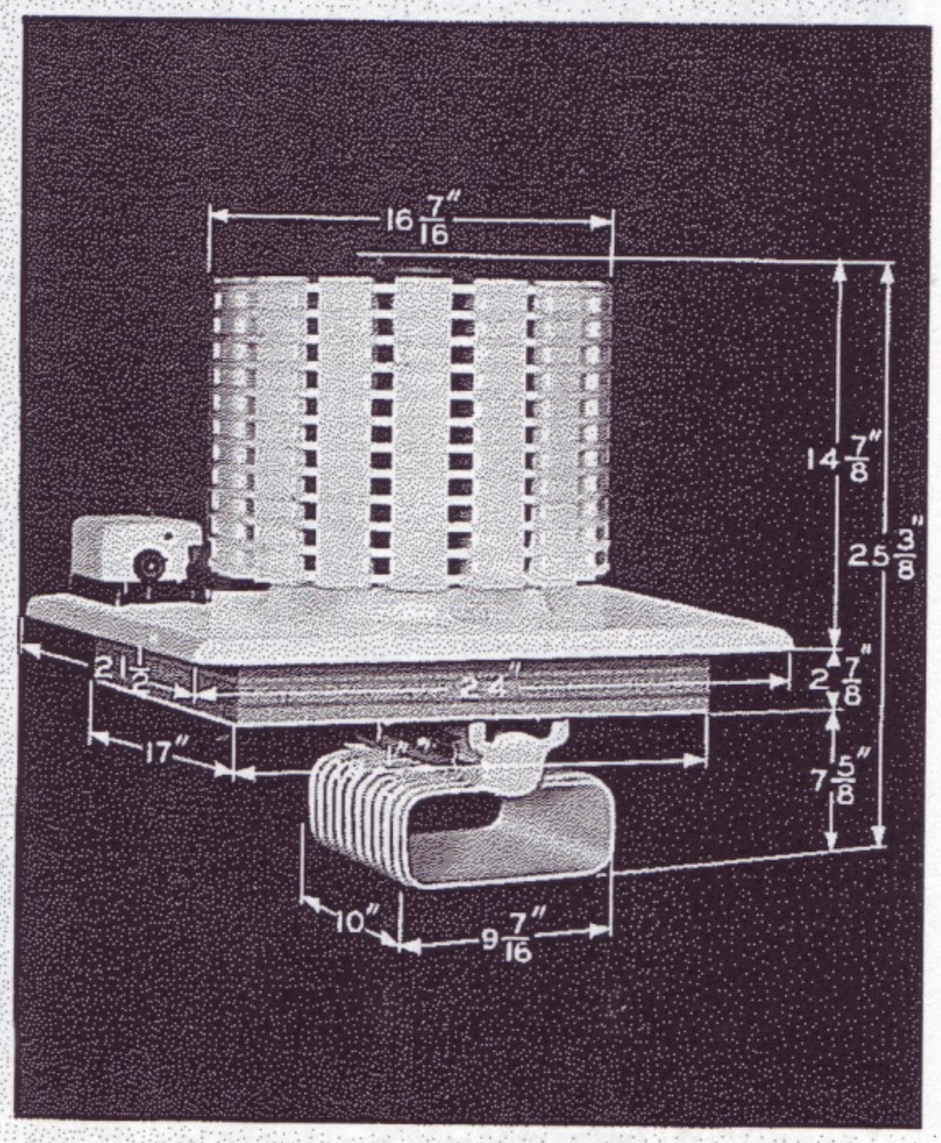


Fig. 18 D15-A-156 *D15-A-16* D15-A-16

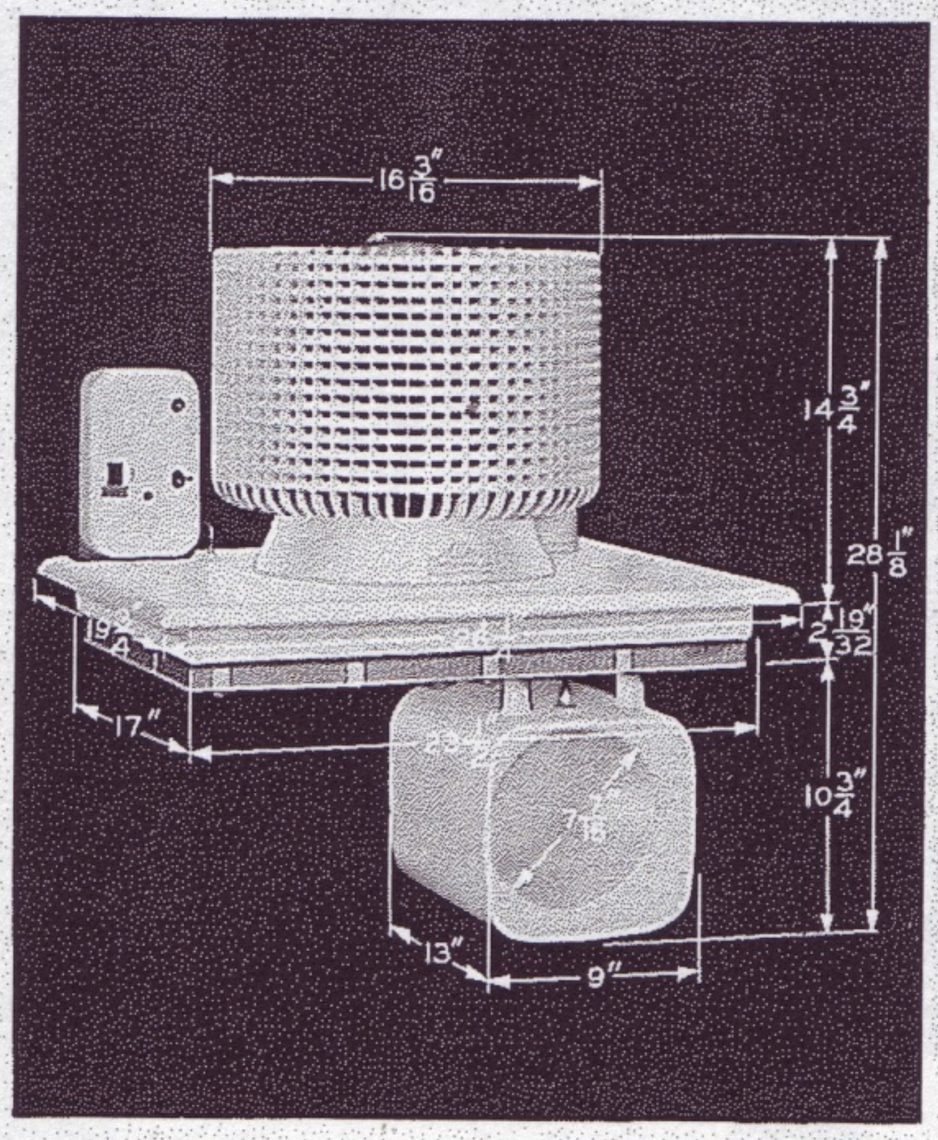


Fig. 19 DR-2-D *DR-2-D16* DR-2-R16
May have Type A or C Control

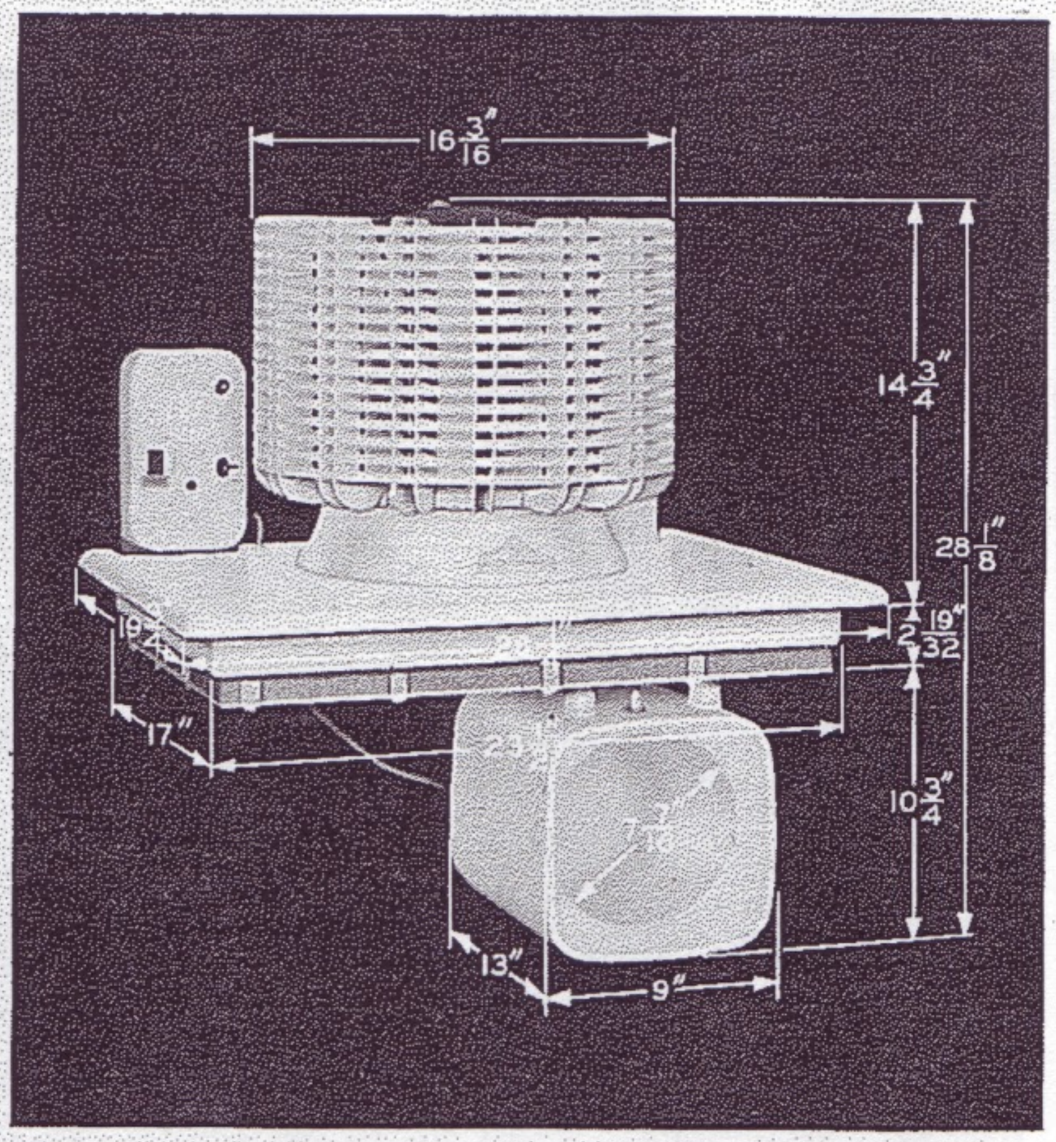


Fig. 20 DR-2-E *DR-2-E16* DR-2-S16

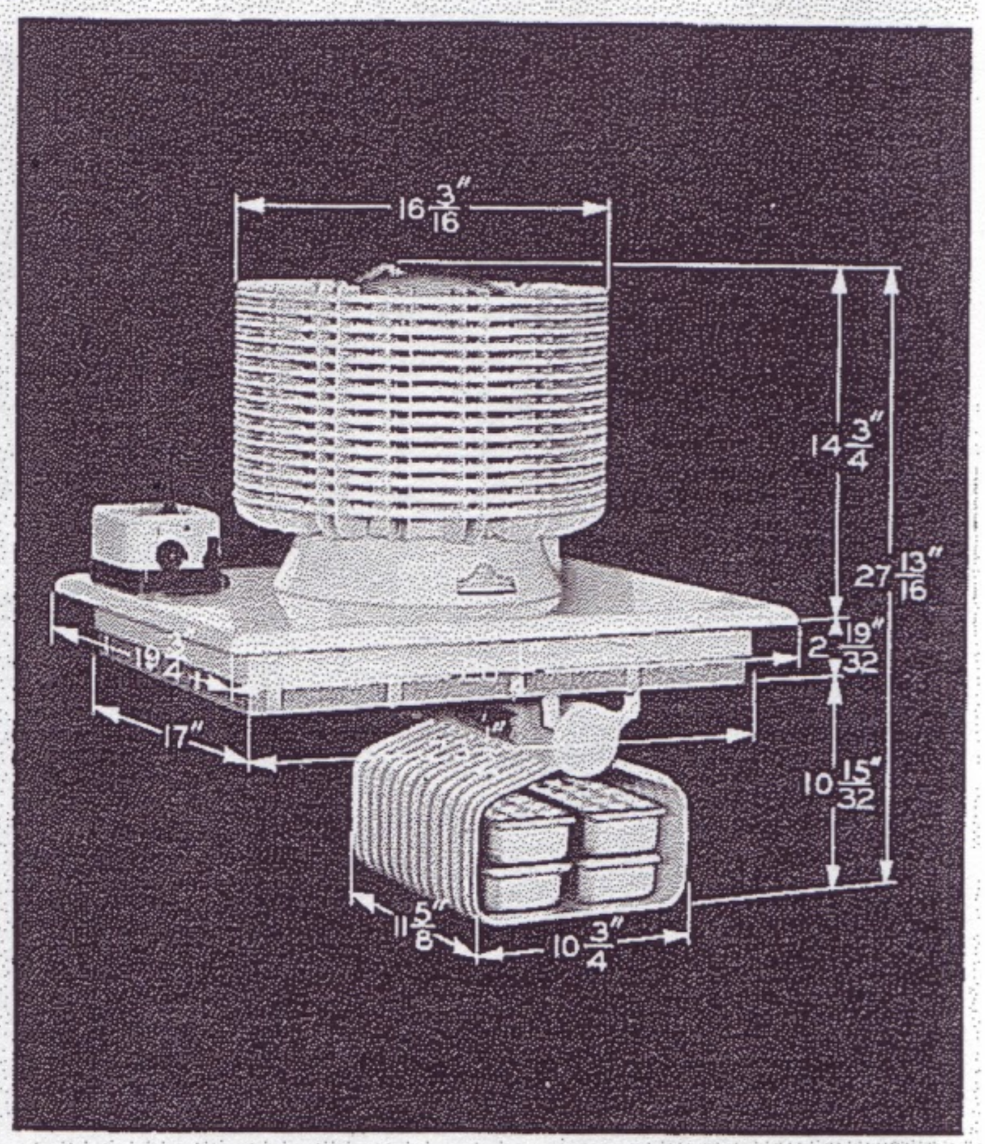


Fig. 21 DR-2-F *DR-2-F16* DR-2-T16

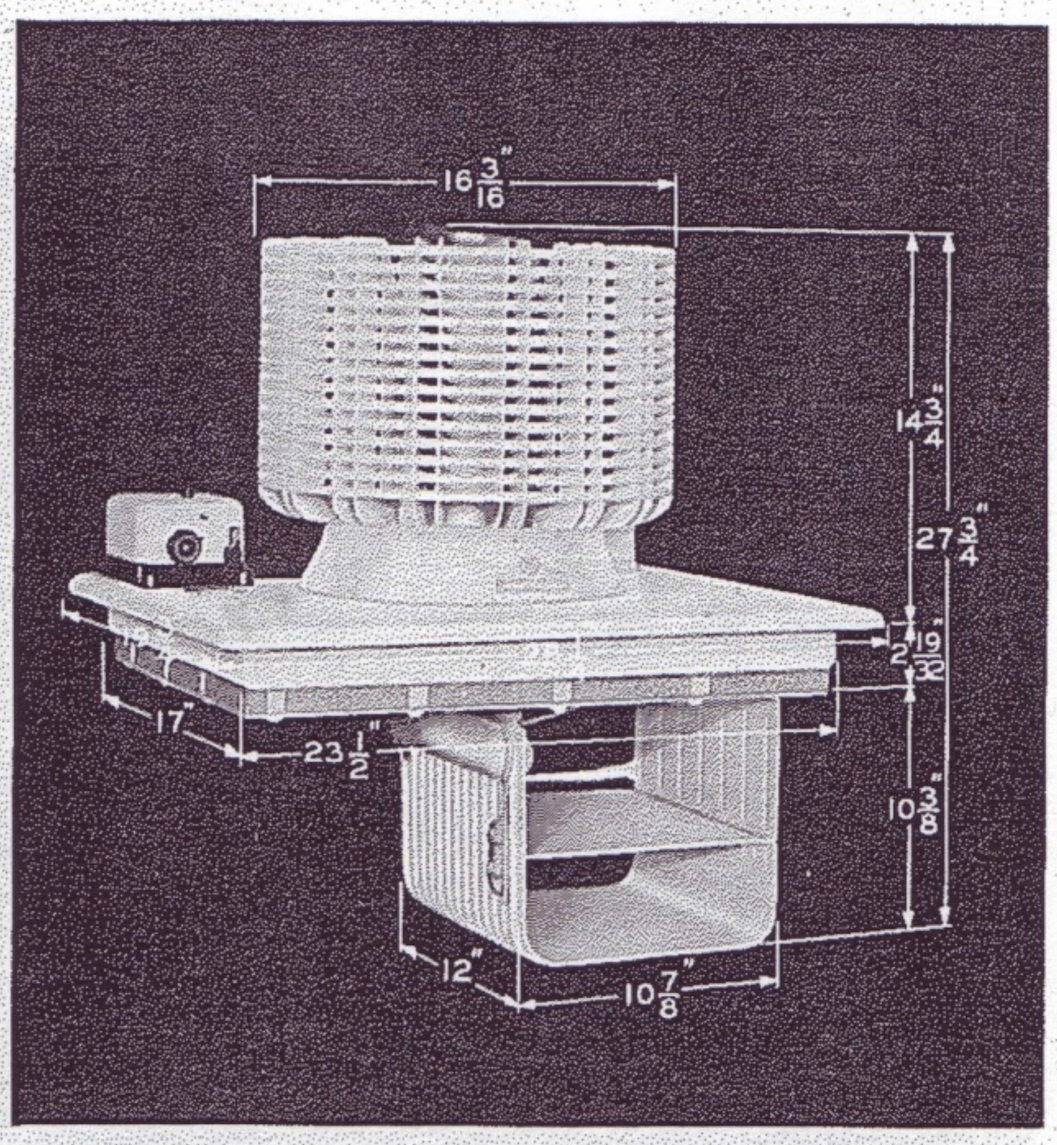


Fig. 22 DR-2-G16 *DR-2-G16* DR-2-G16
May have 32 or 64 fin condenser, Type C or E control

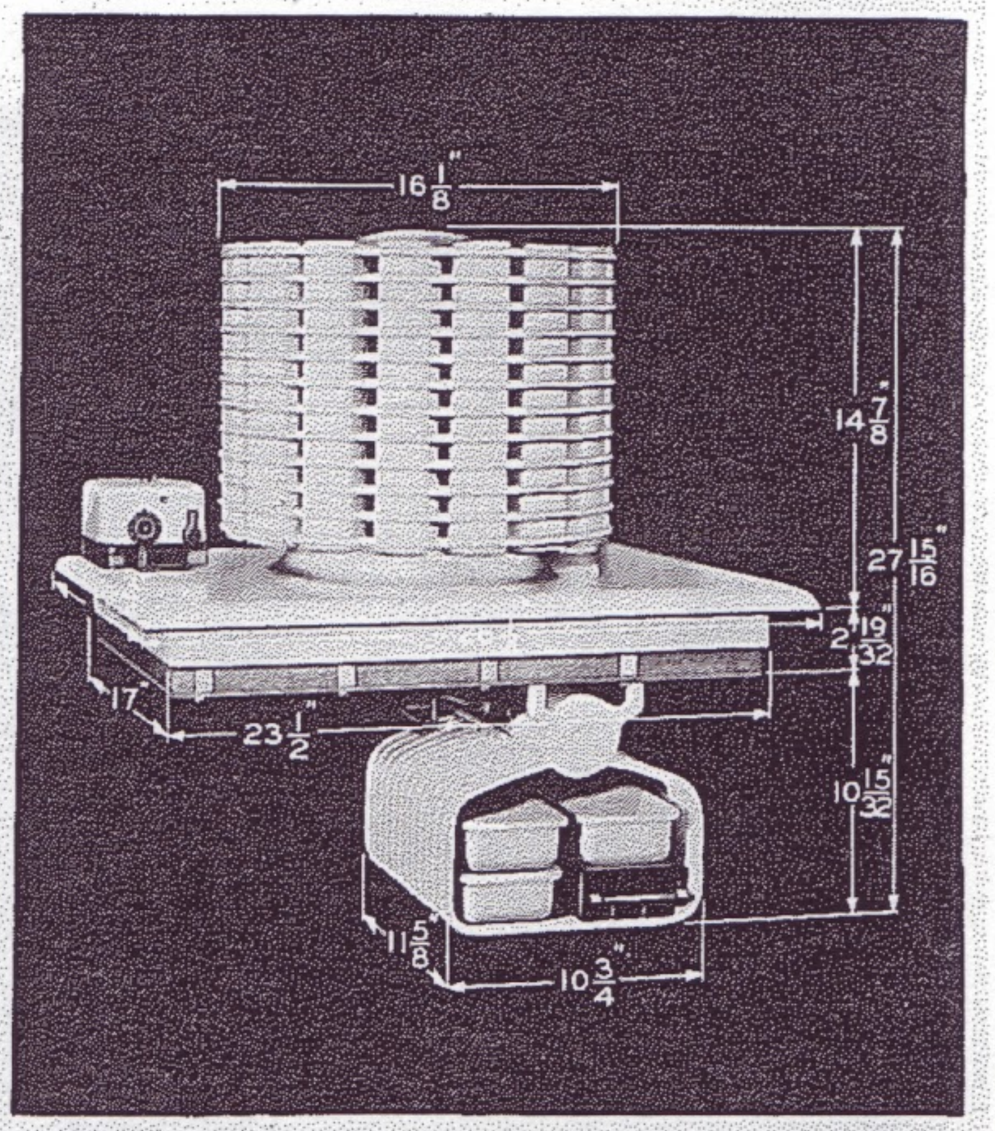


Fig. 23 D-2-A16 *D-2-A16* D-2-A16

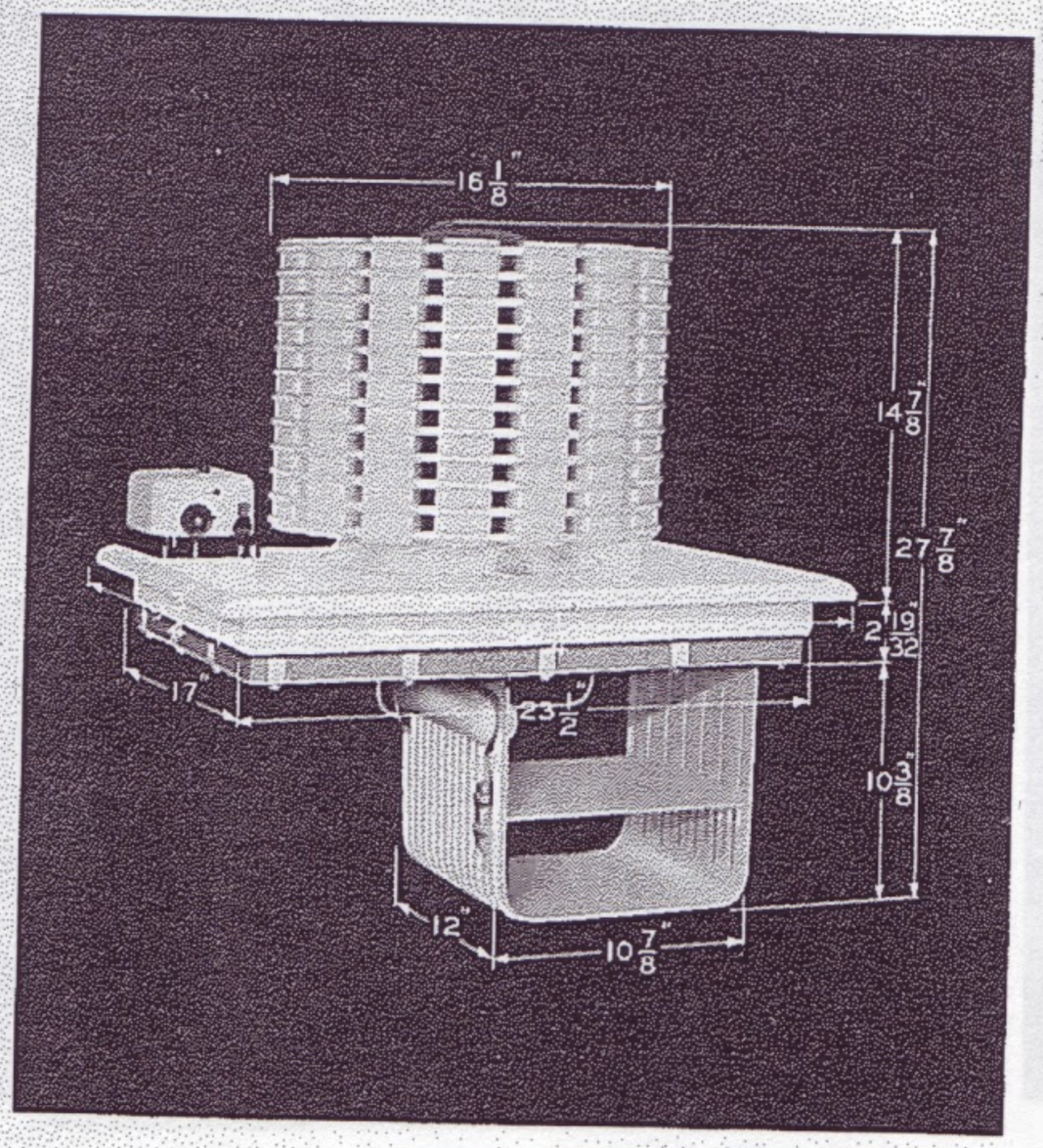


Fig. 24 D-2-B16 *D-2-B16* **D-2-B16**

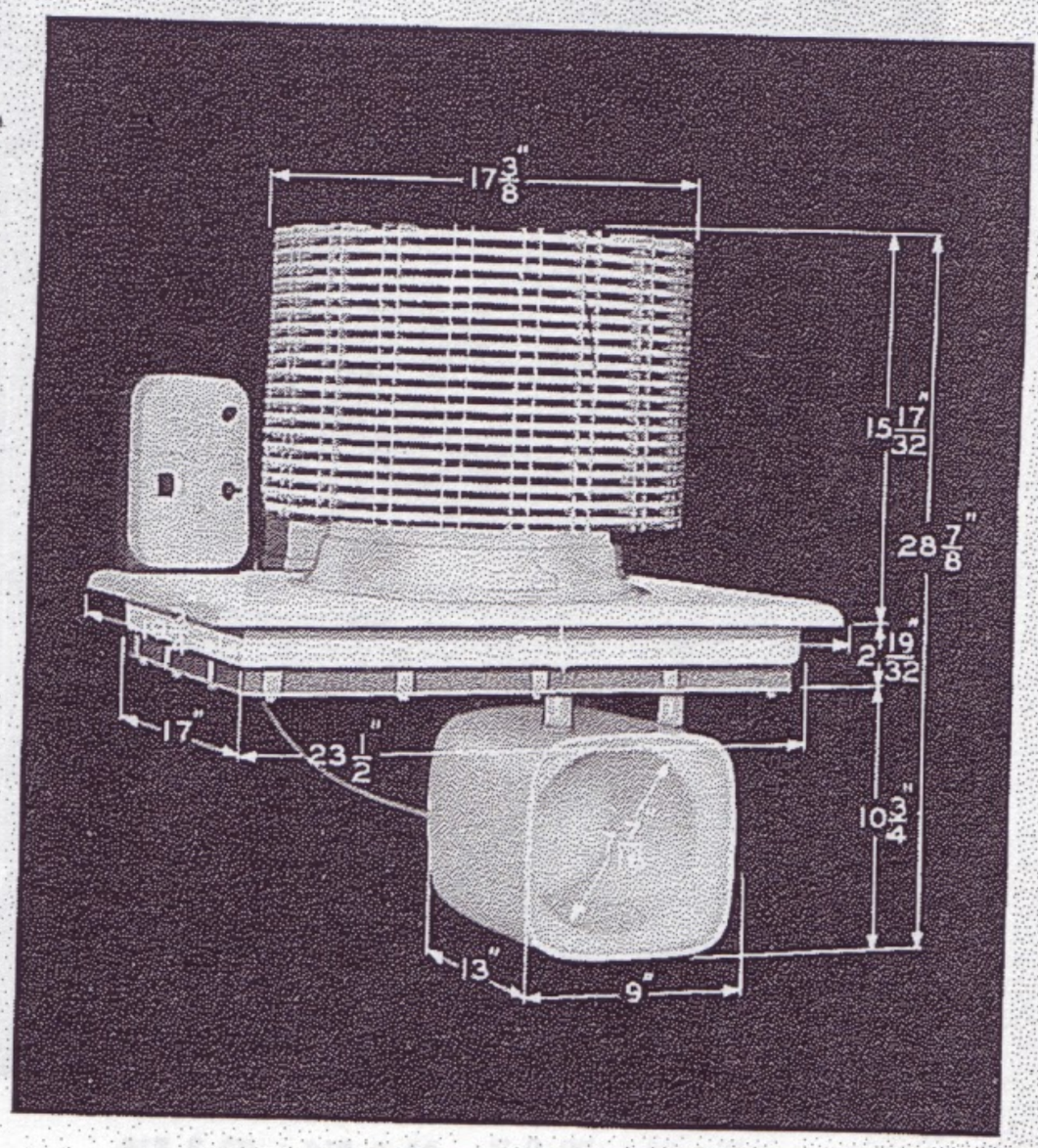


Fig. 25 DRB-3-L2 *DRB-3-16* **DRB-3-A16**
DRB-3-L1 Same but with 80 fin condenser

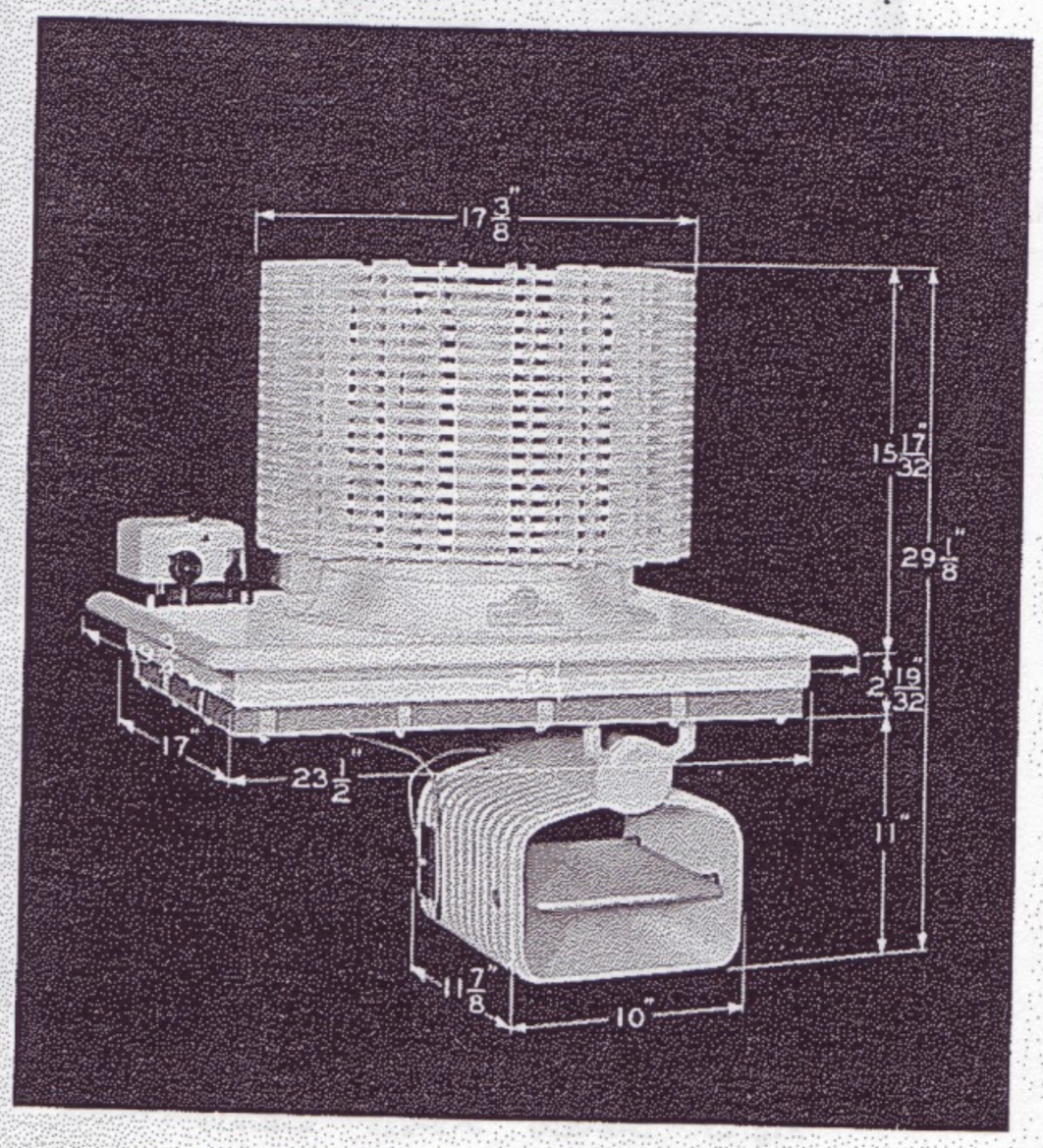


Fig. 26 DRB-31-A16 *DRB-31-A16* **DRB-31-A16**
May have 40 or 80 fin condenser

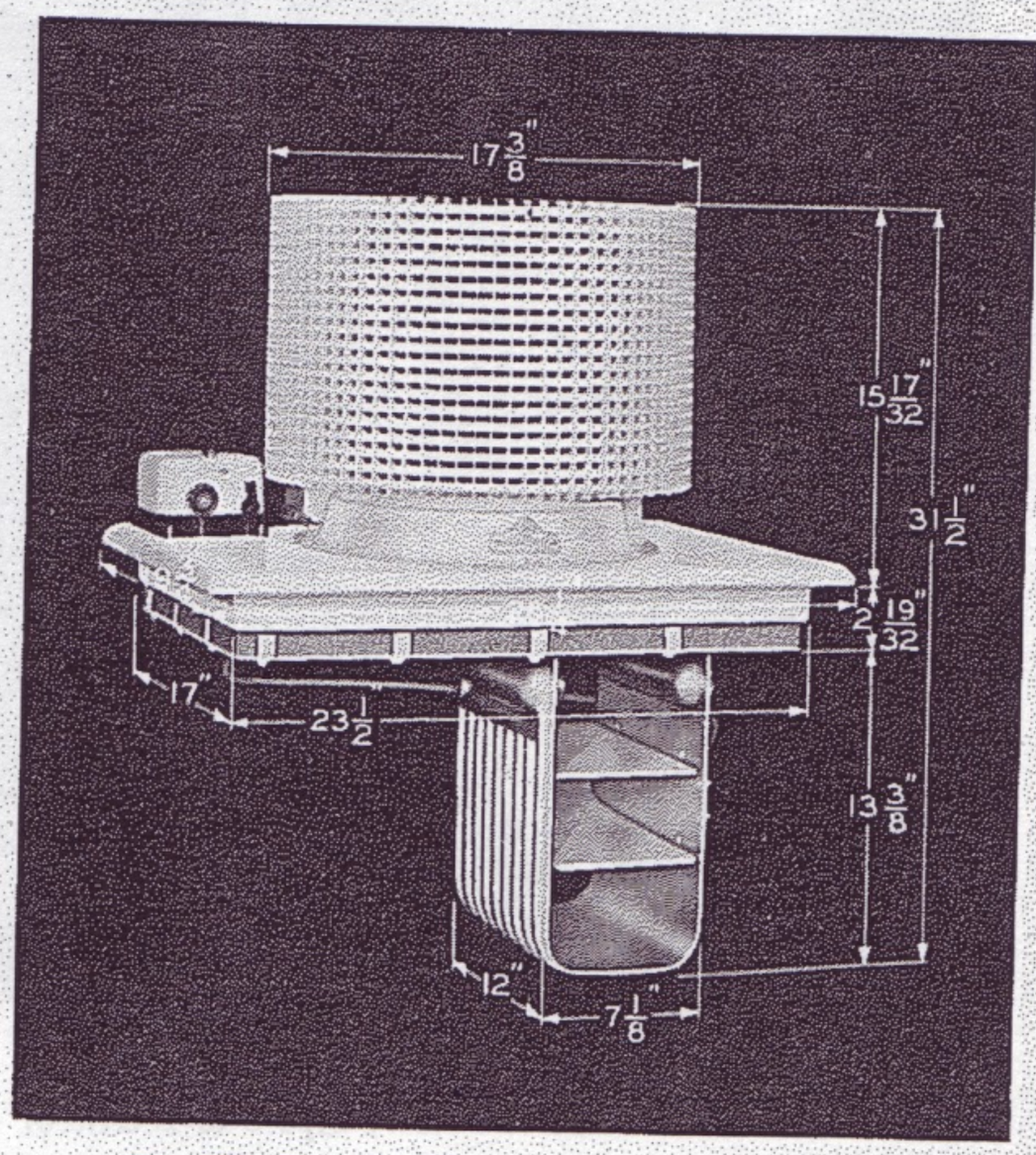


Fig. 27 DRB-31-B16 *DRB-31-B16* **DRB-31-B16**
May have 40 or 80 fin condenser

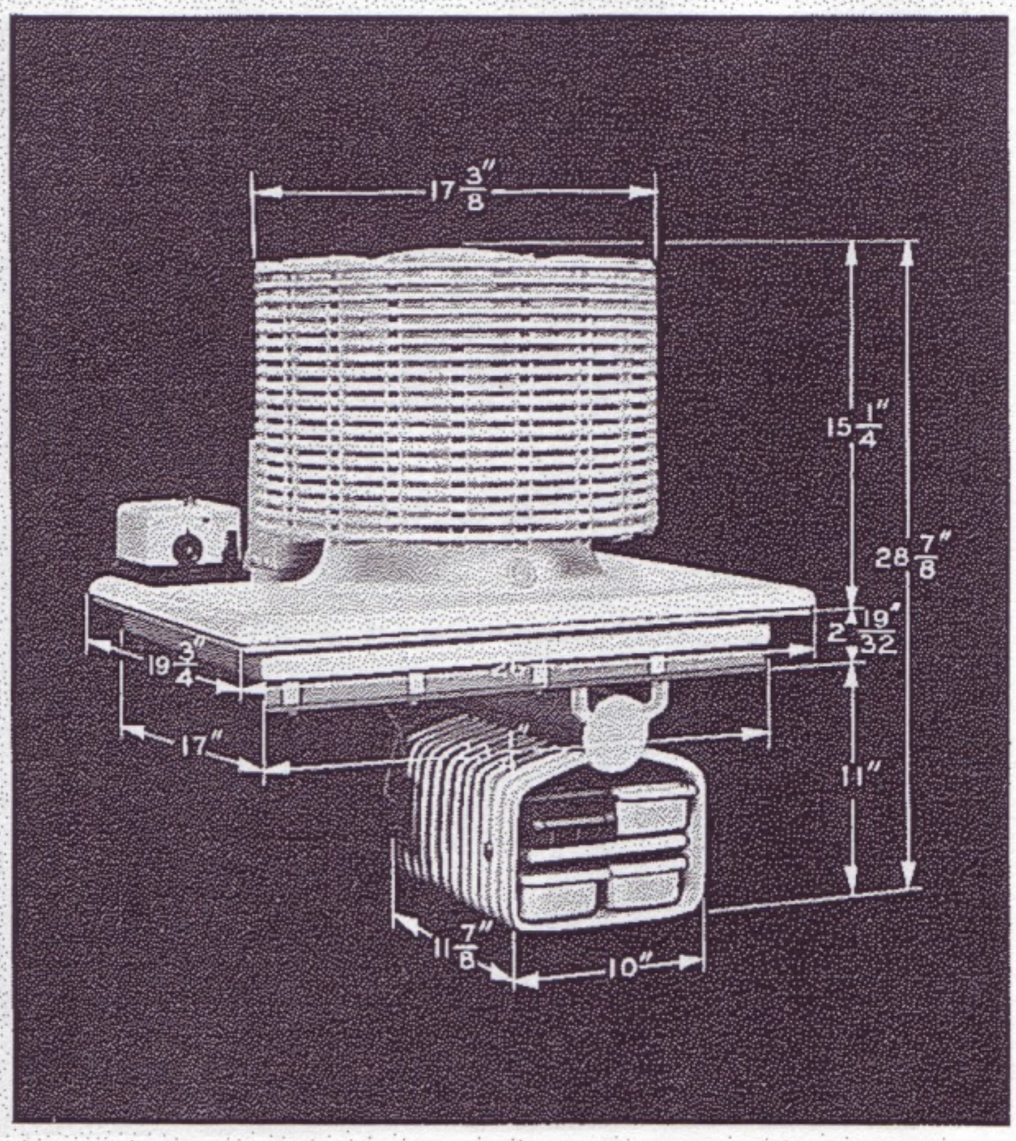


Fig. 28 D-31-A16 *D-31-A16* D-31-A16
May have 40 or 80 fin condenser

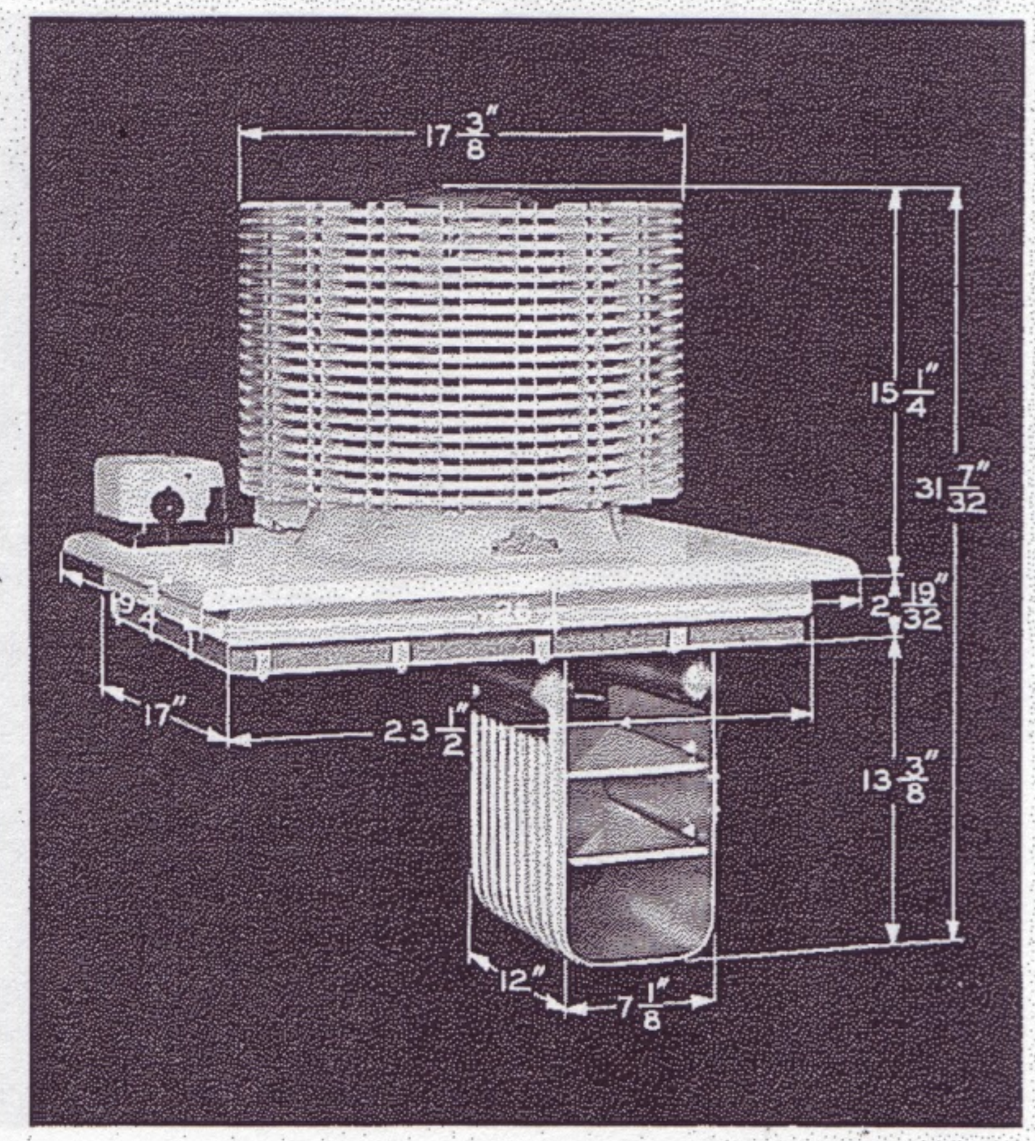


Fig. 29 D-31-B16 *D-31-B16* D-31-B16
D-30-D16 *D-30-D16* D-30-D16
May have 40 or 80 fin condenser

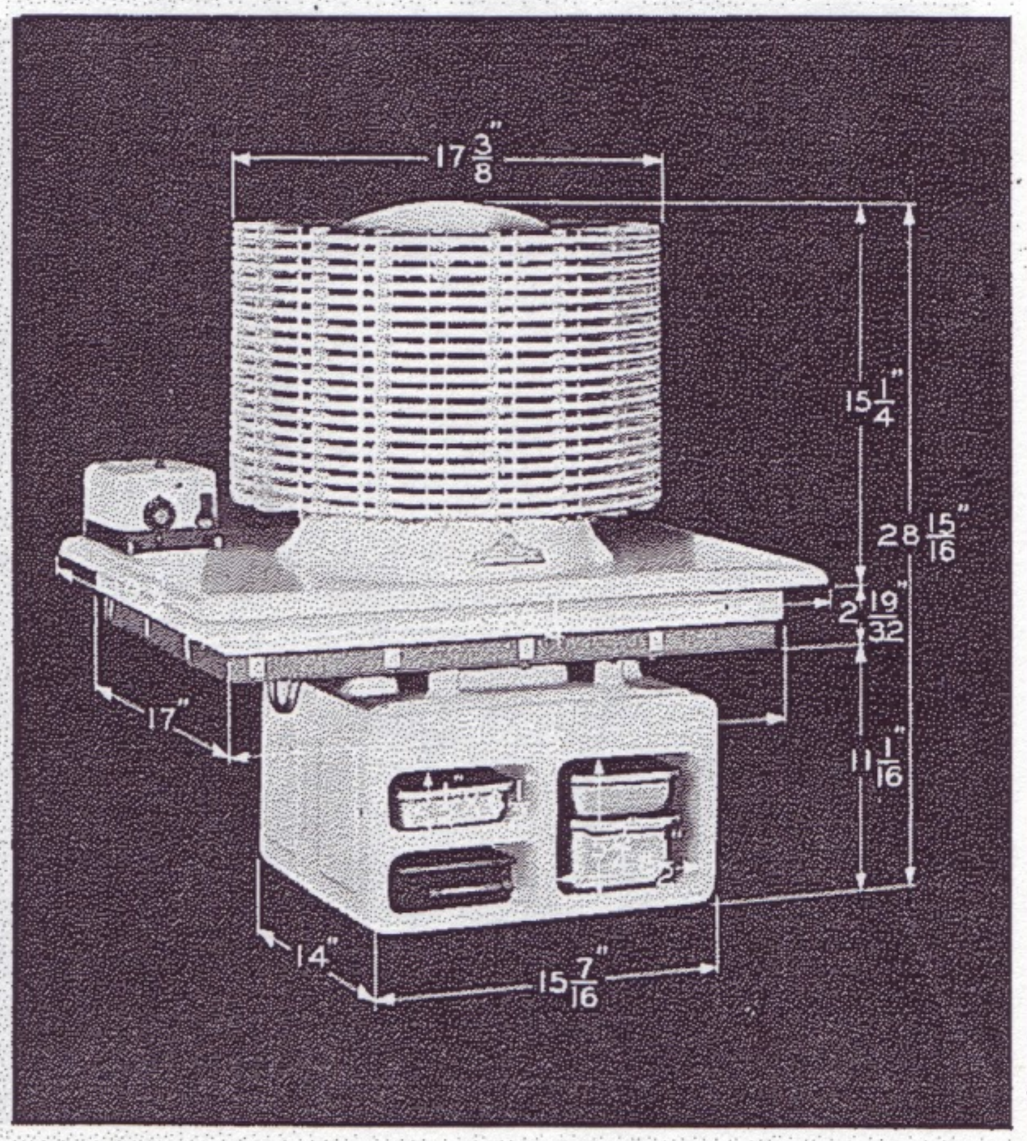


Fig. 30 D-30-A16 *D-30-A16* D-30-A16

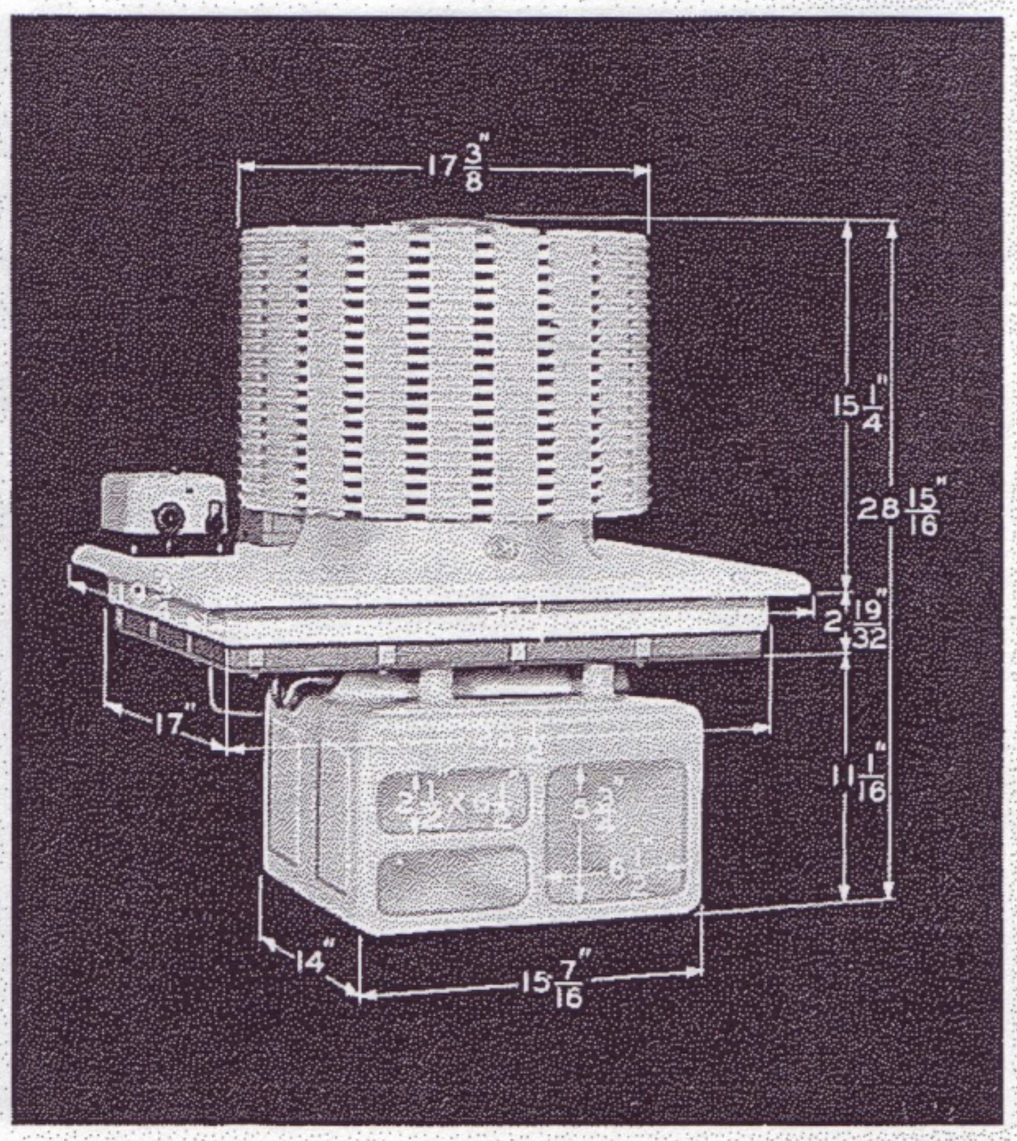


Fig. 31 D-30-B16 *D-30-B16* D-30-B16

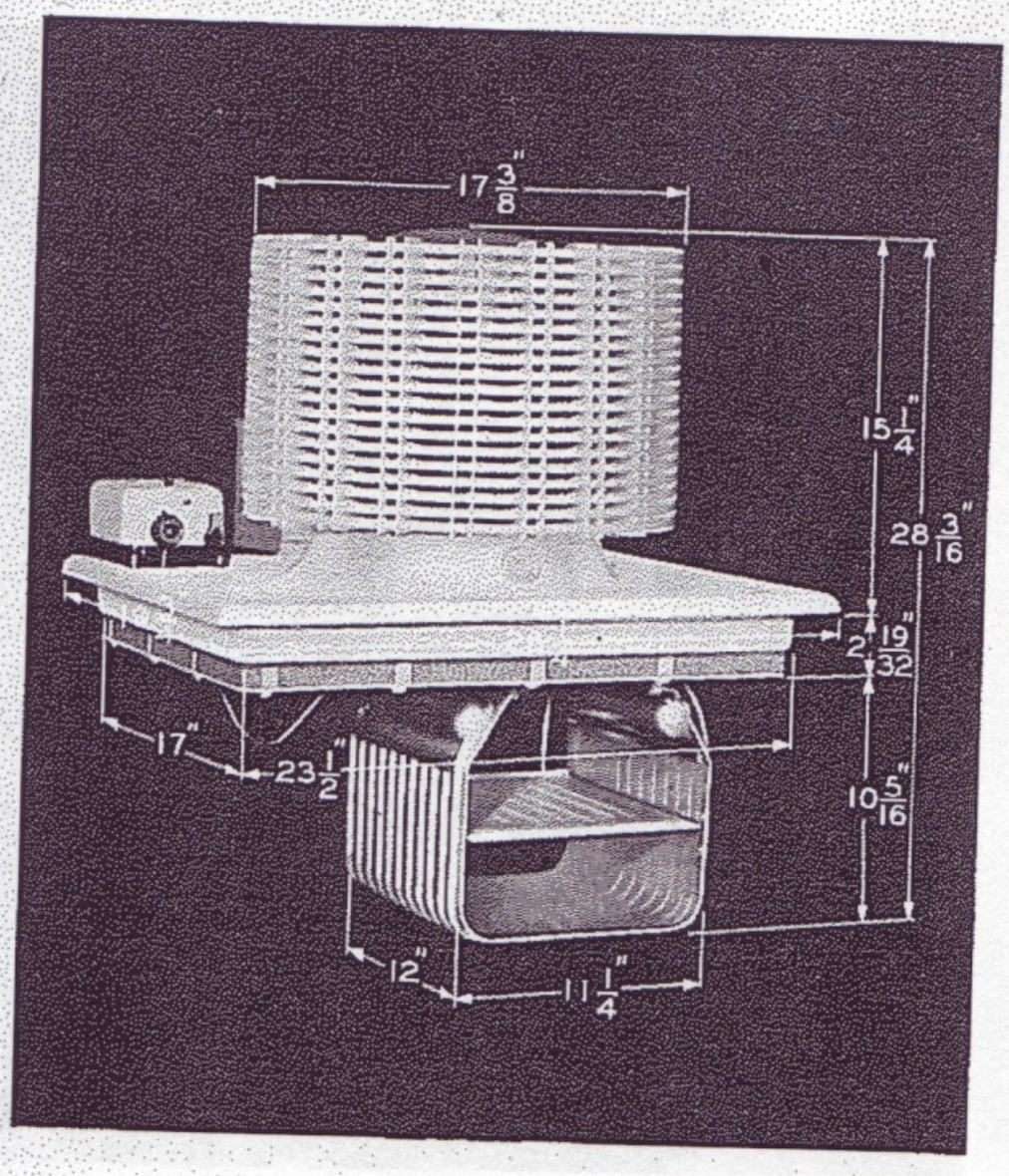


Fig. 32 D-30-E16 *D-30-F16* D-30-E16

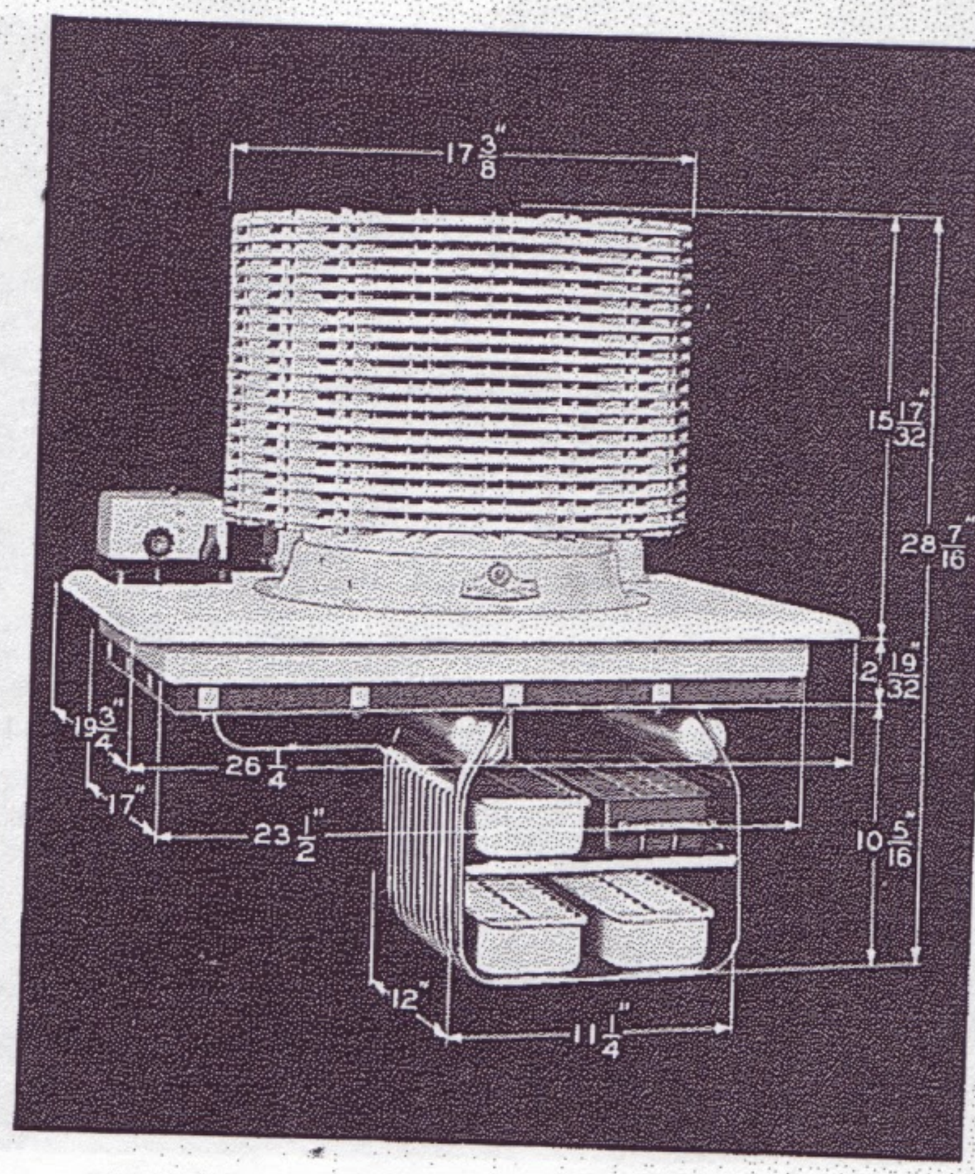


Fig. 33 D-30-F16 *D-30-F16* D-30-F16
May have 40 or 80 fin condenser

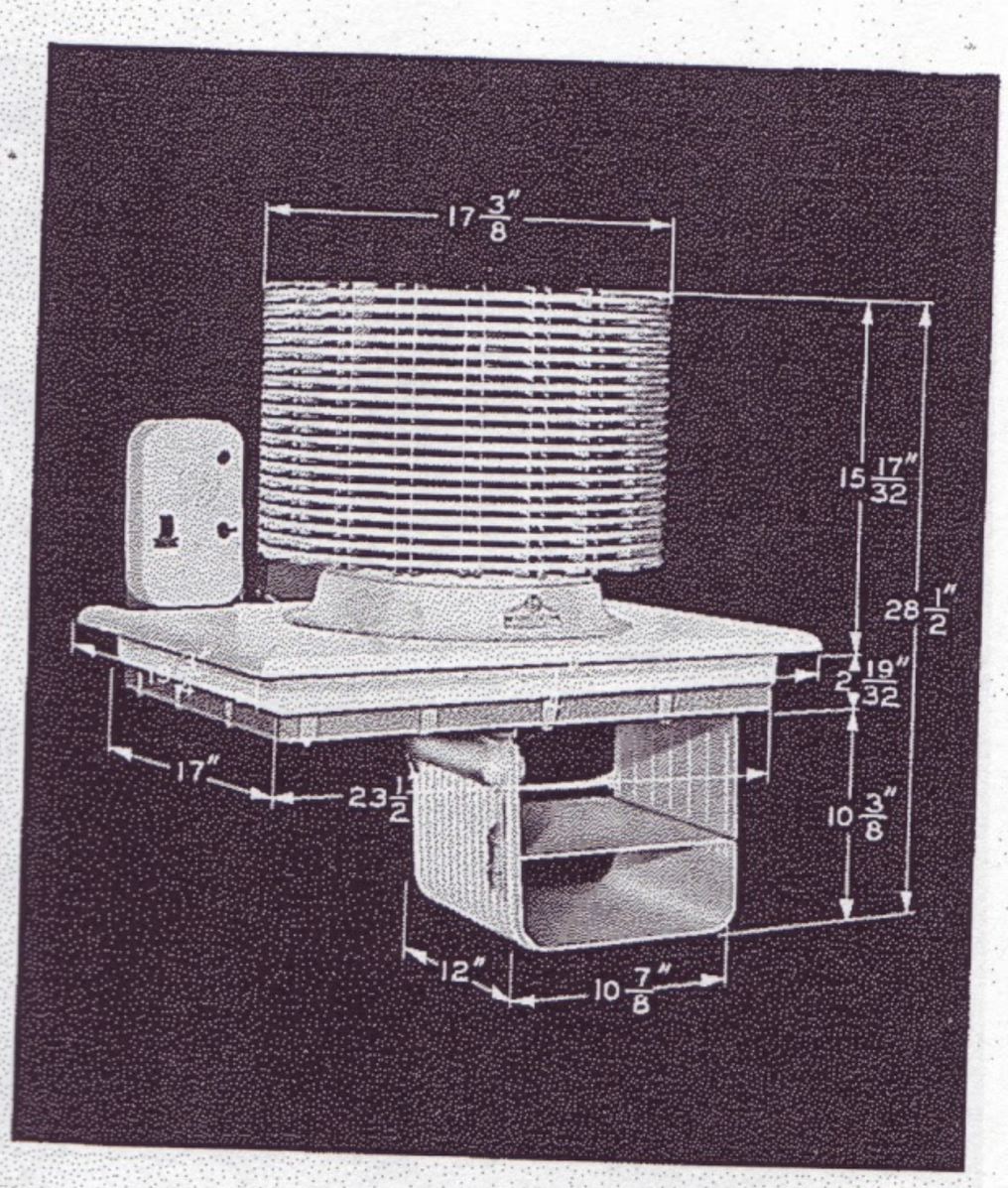


Fig. 34 D-30-G16 *D-30-G16* D-30-G16
May have 40 or 80 fin condenser

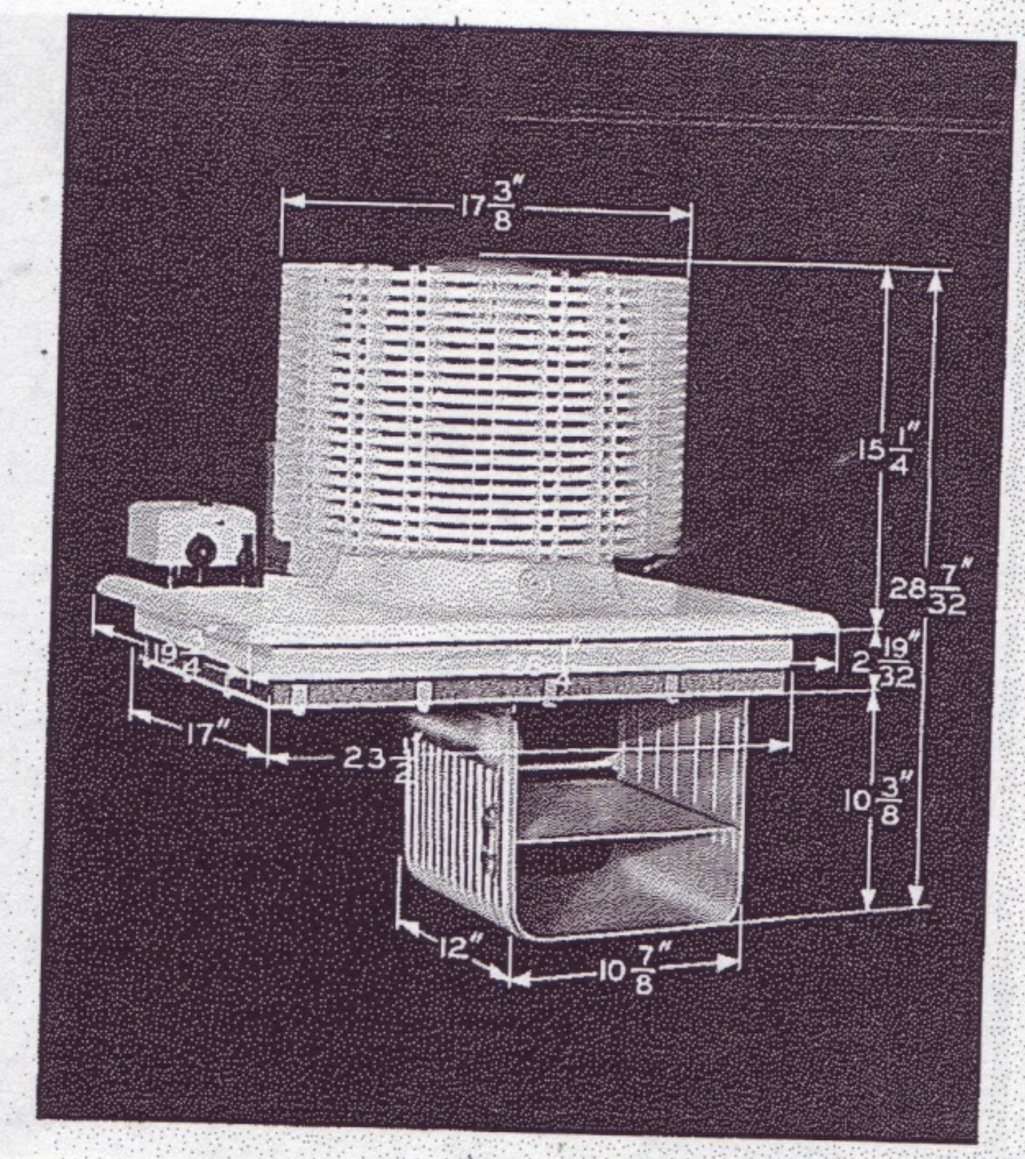


Fig. 35 D-30-H16 *D-30-H16* D-30-H16
May have inverted or 40 fin condenser

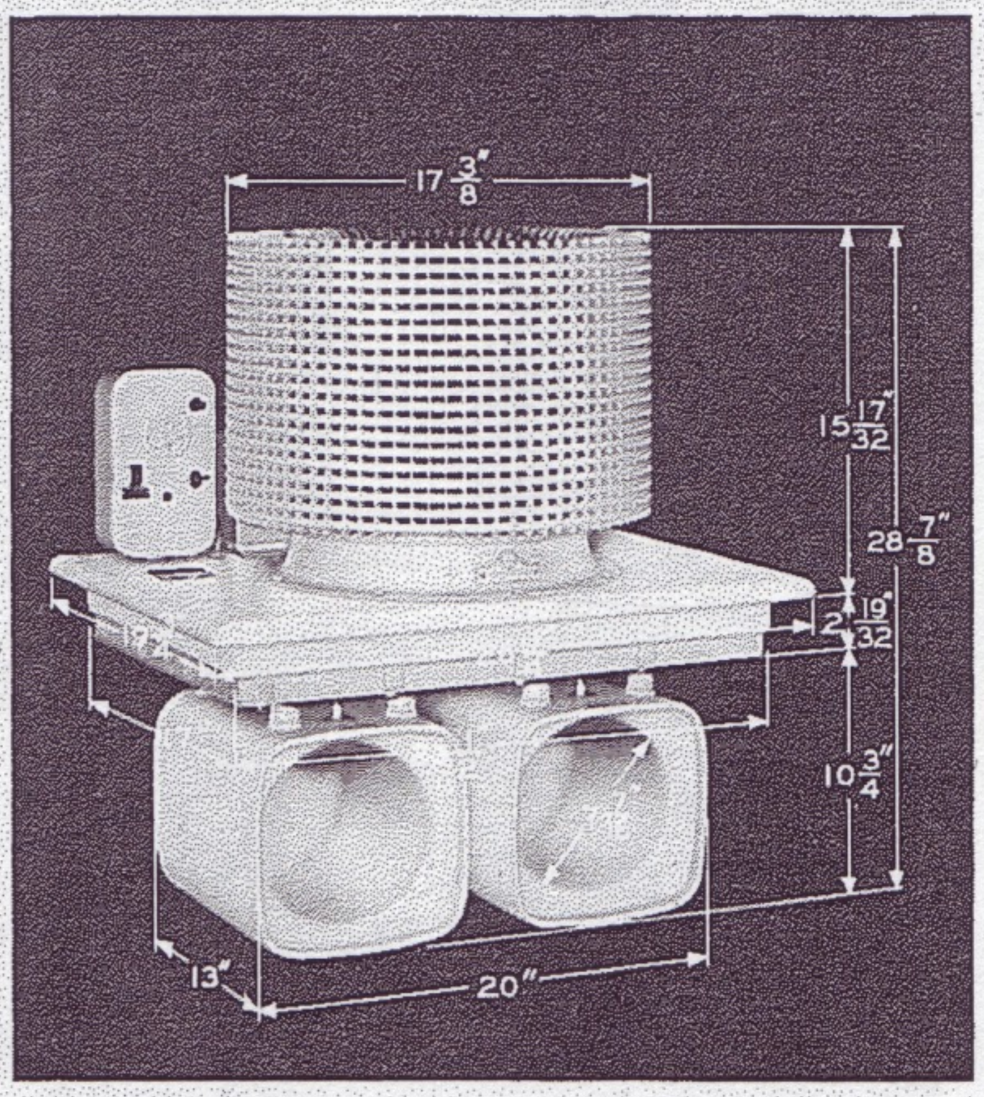


Fig.36 DR-3-D *DR-3-16* DR-3-R16
May have Type "A" or "C" control

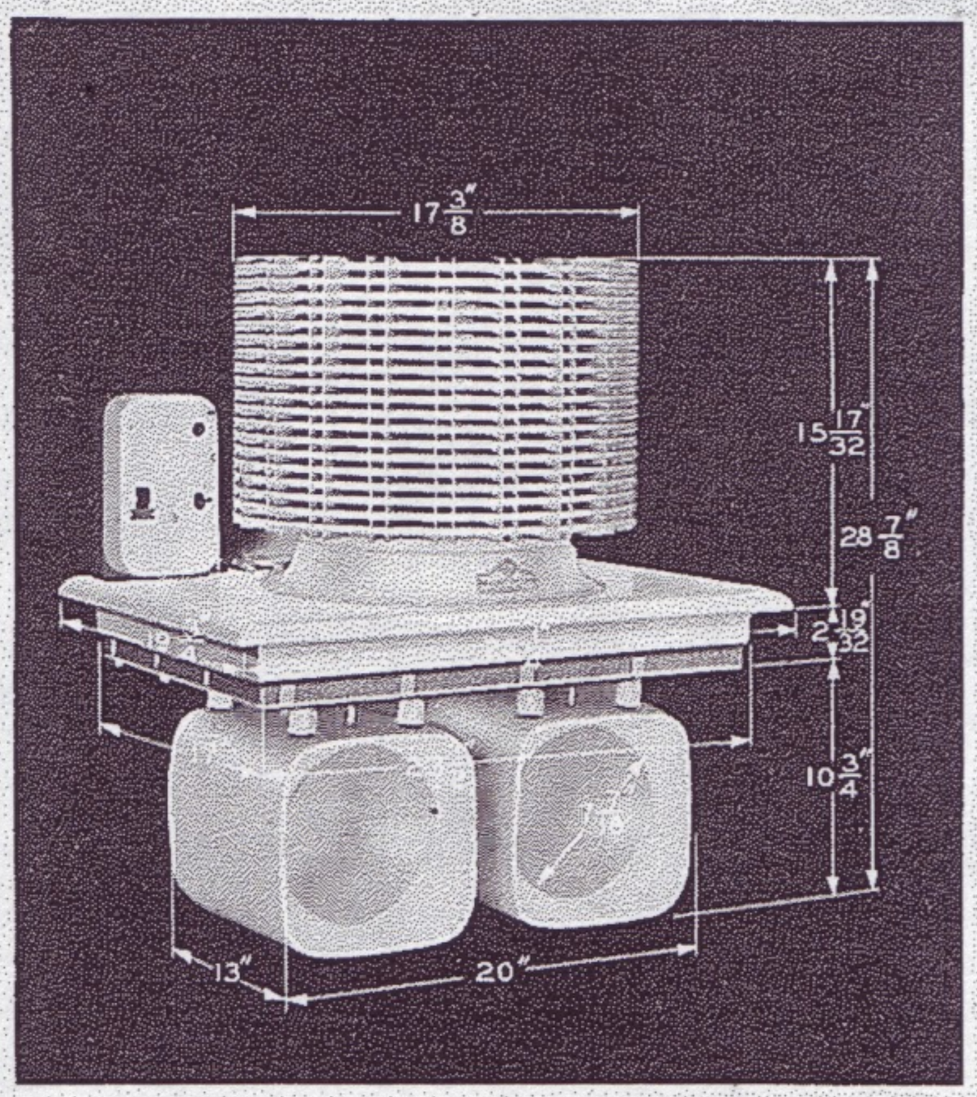


Fig.37 DR-3-L2 *DR-3-16* DR-3-S16
DR-3-L1 Same but with 80 fin condenser

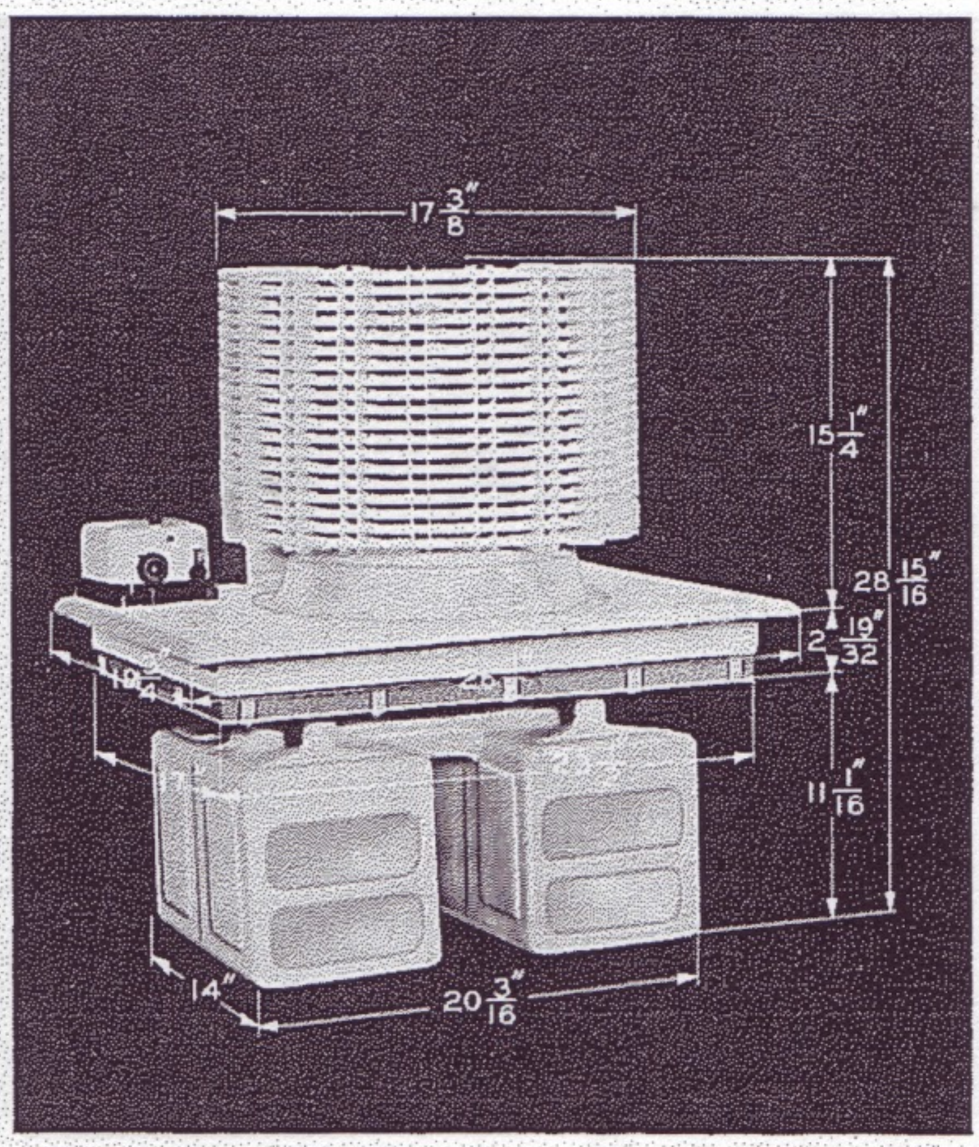


Fig.38 DRE-3-L2 *DRE-3-16* DRE-3-B16
DRE-3-L1 similar but with 80 fin condenser;
Either one may have Type "C" or "E" control

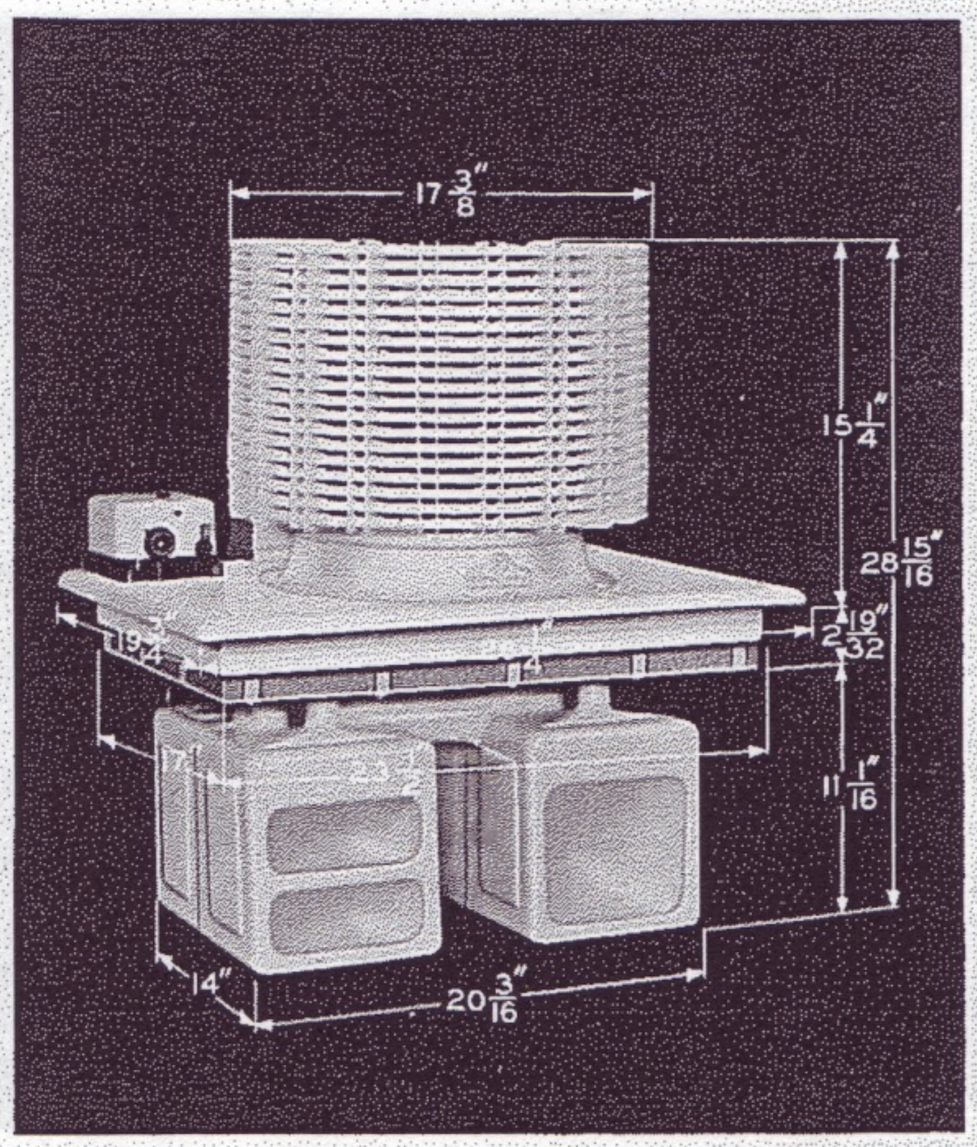


Fig.39 DR-35-A16 *DR-35-A16* DR-35-A15
May have 40 or 80 fin condenser

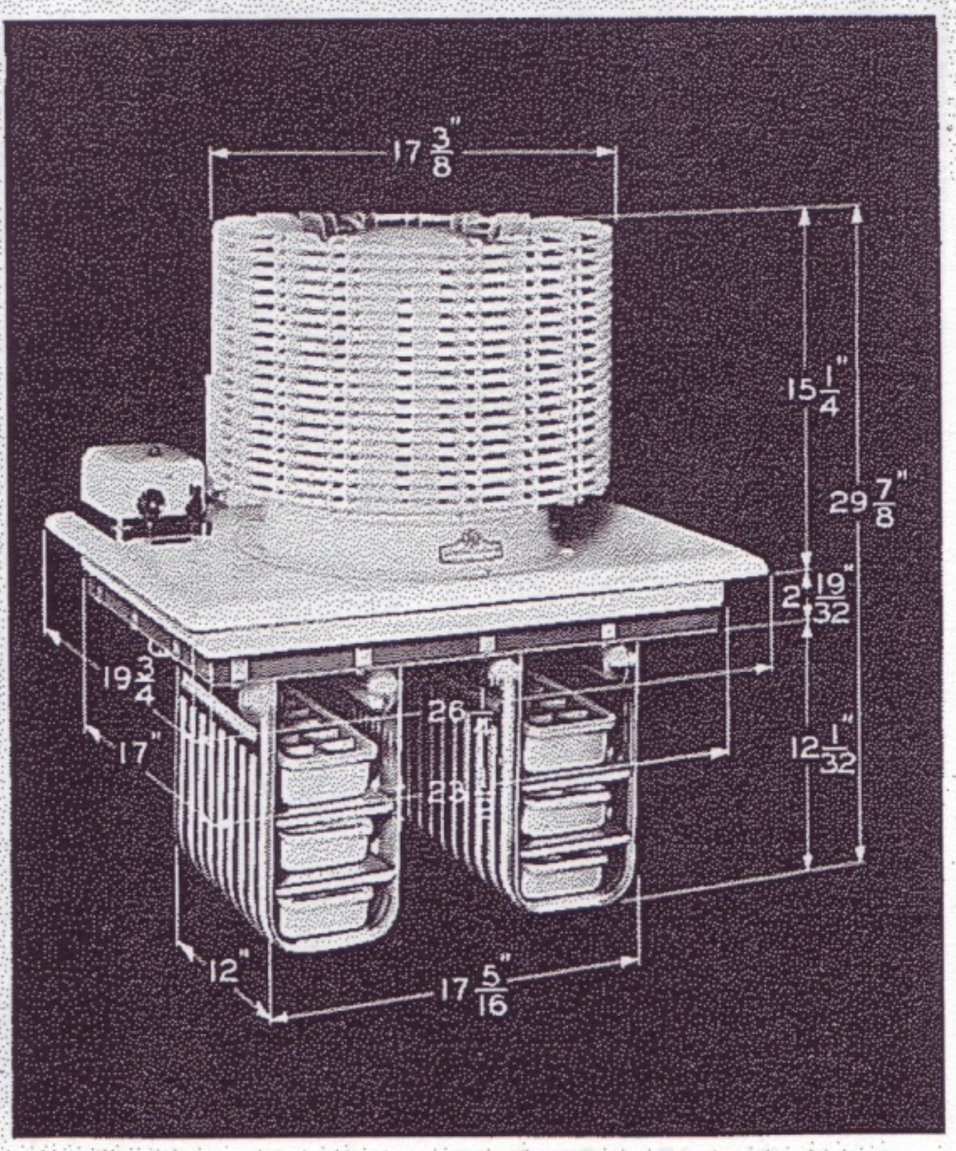


Fig.40 DR-35-B16 *DR-35-B16* DR-35-B16
May have 40 or 80 fin condenser

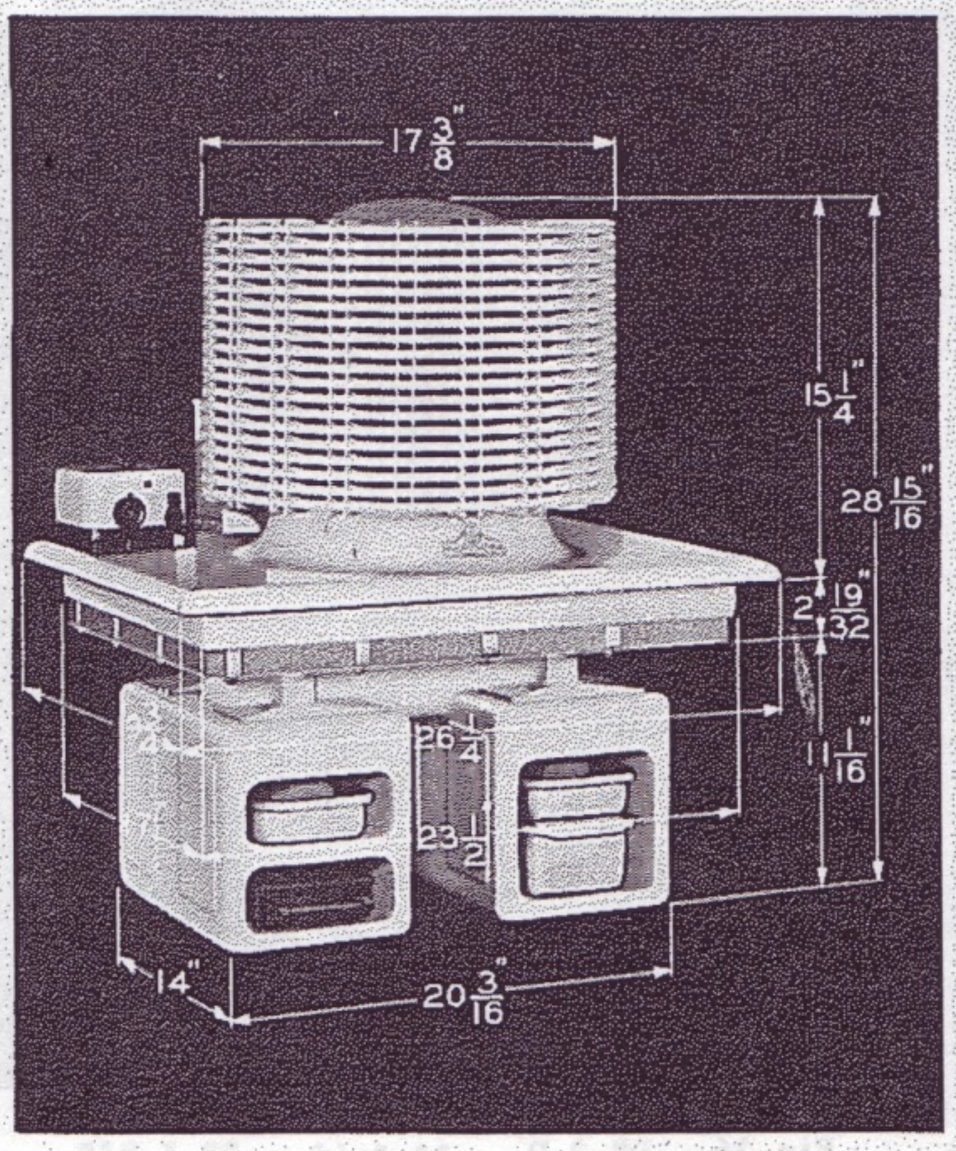


Fig.41 D-35-A16 *D-35-A16* D-35-A16
May have 40 or 80 fin condenser

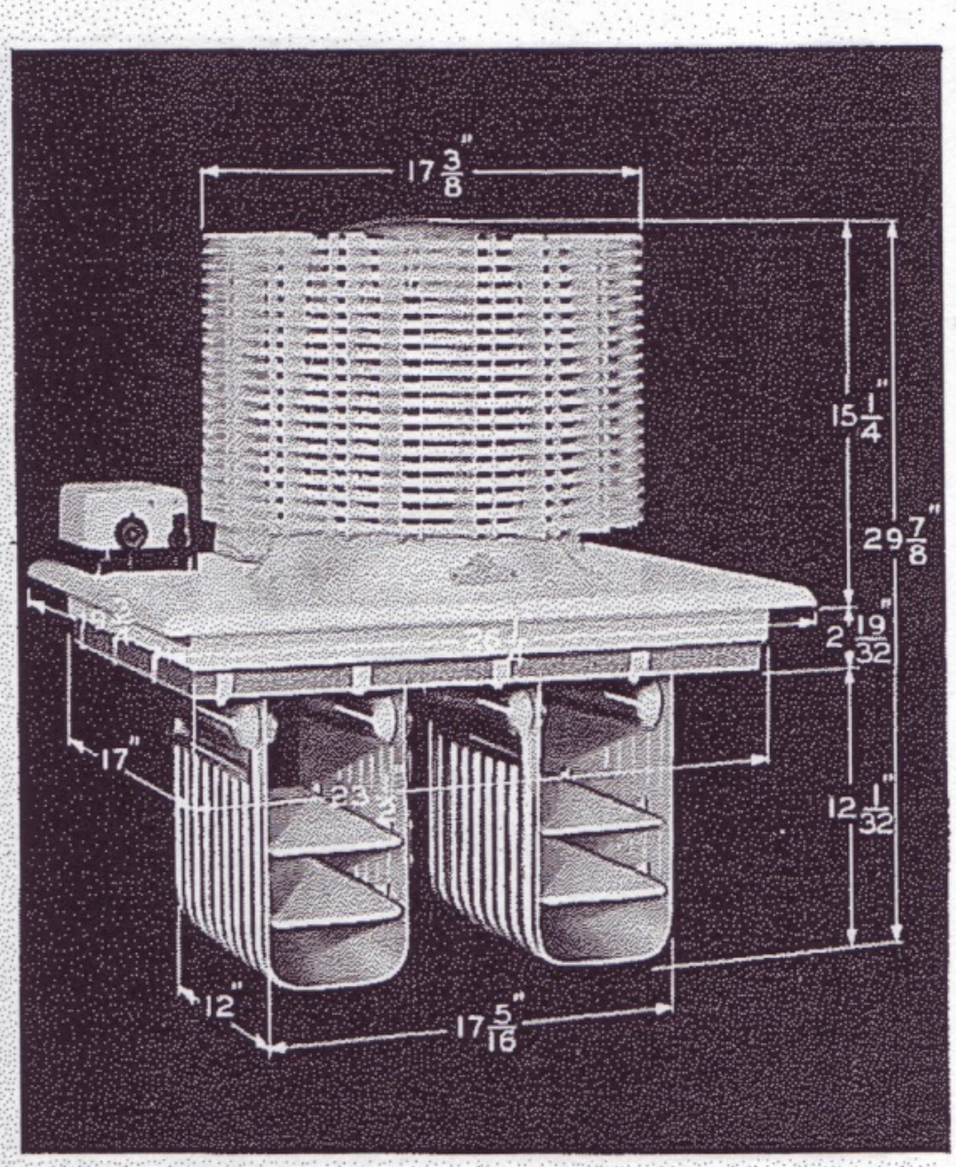


Fig.42 D-35-B16 *D-35-B16* D-35-B16
May have inverted fin condenser

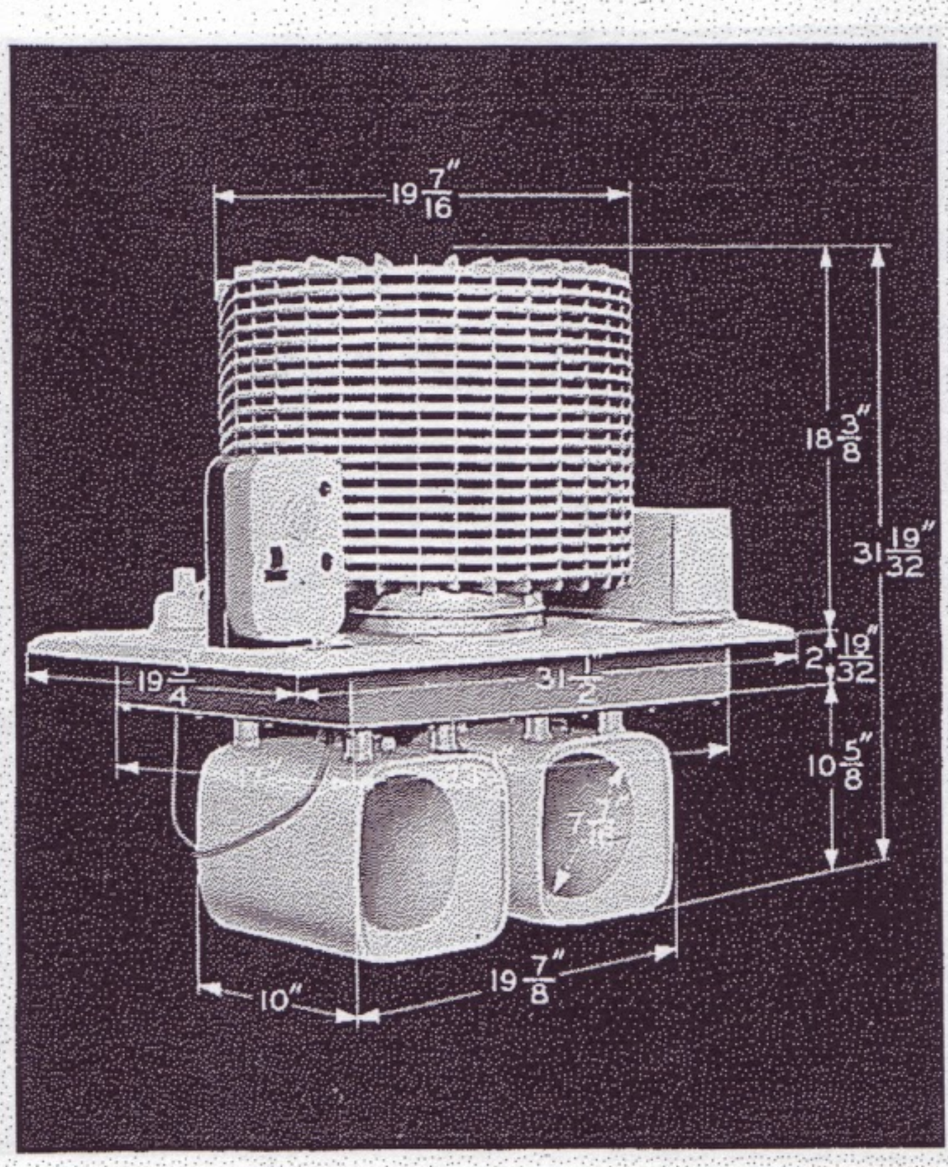


Fig.43 DRA-4-L1 *DRA-4-16* DRA-4-16

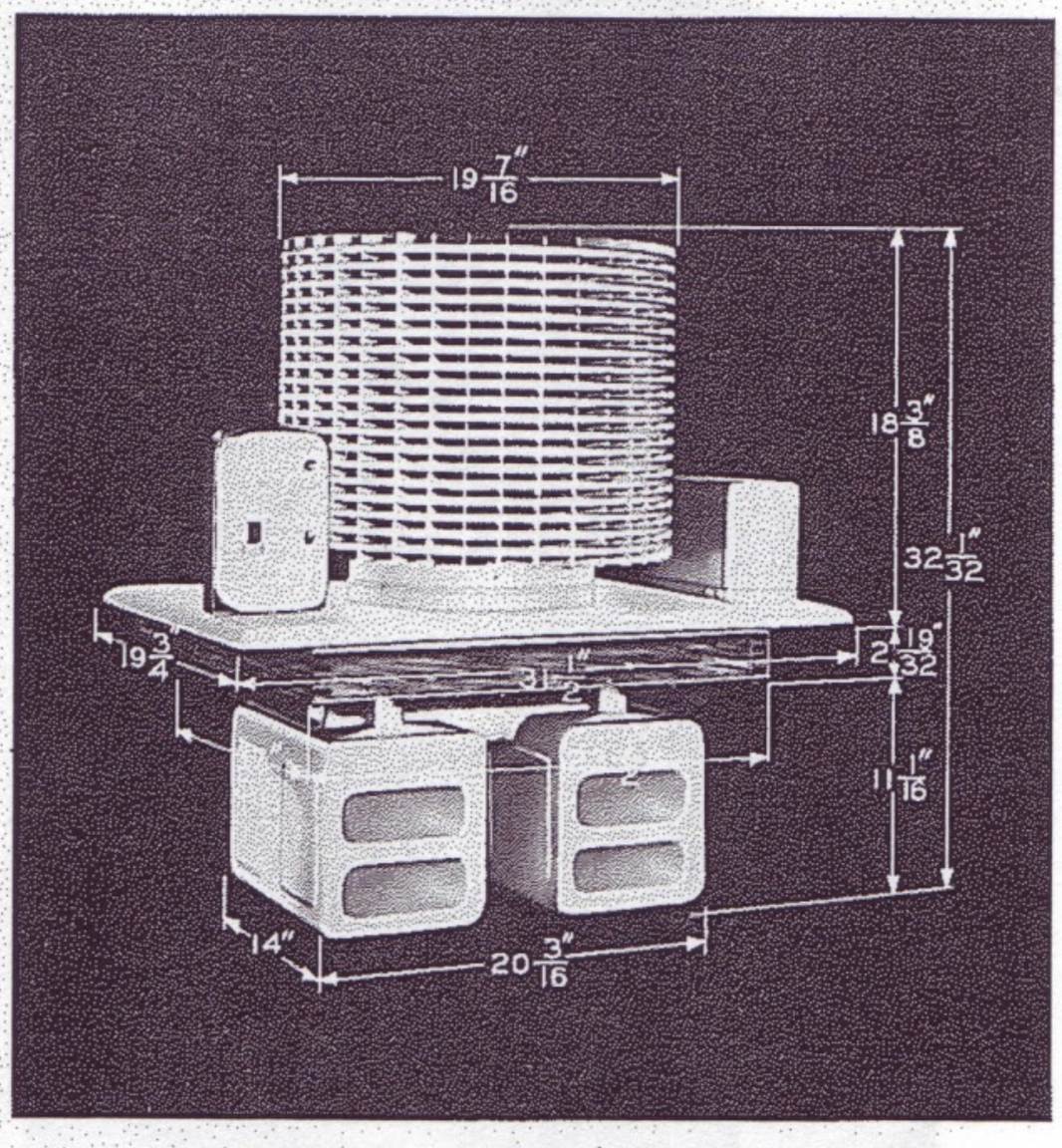


Fig.44 DRE-4-L1 *DRE-4-16* DRE-4-A16

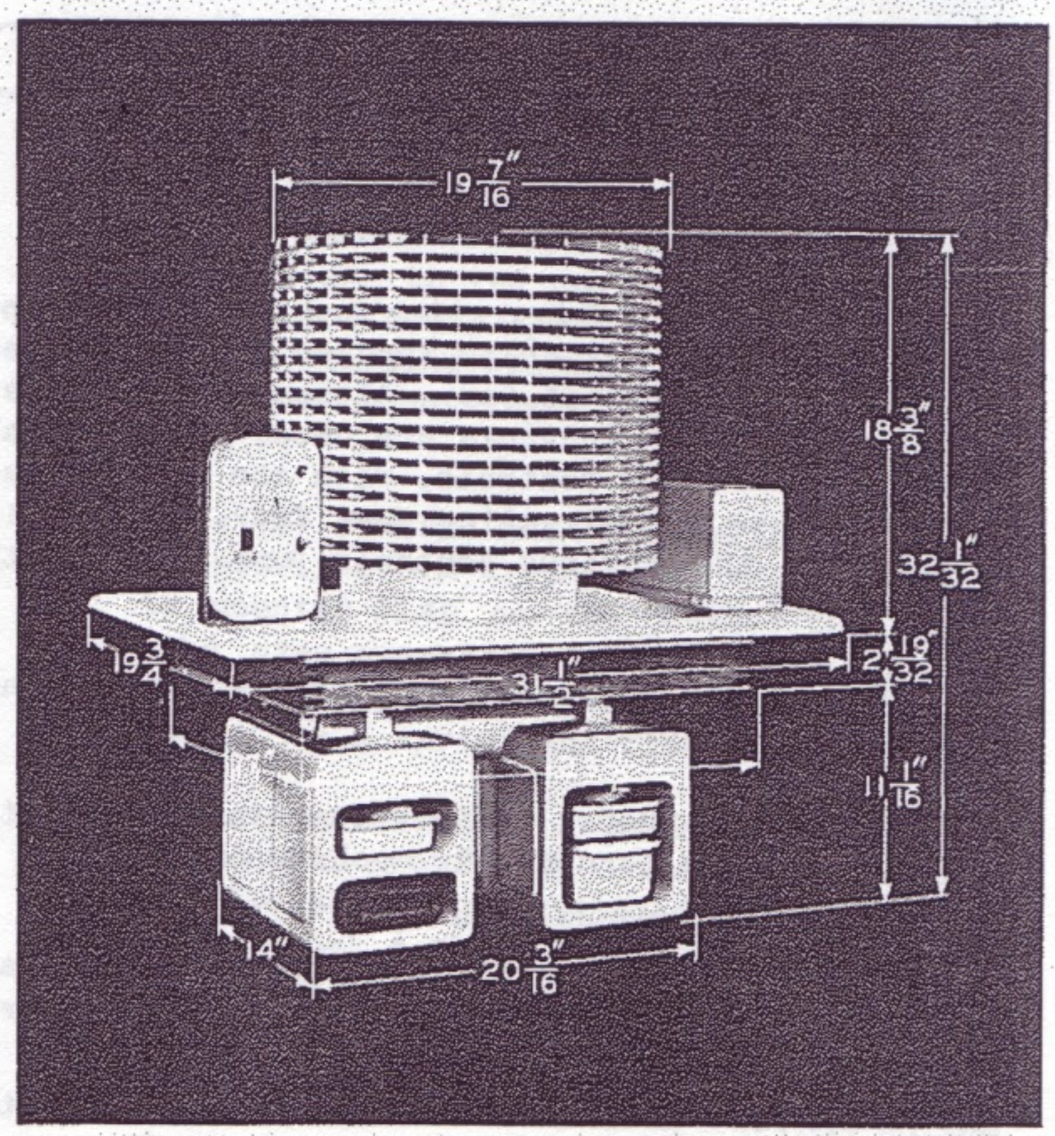


Fig.45 D-40-A16 *D-40-A16* D-40-A16

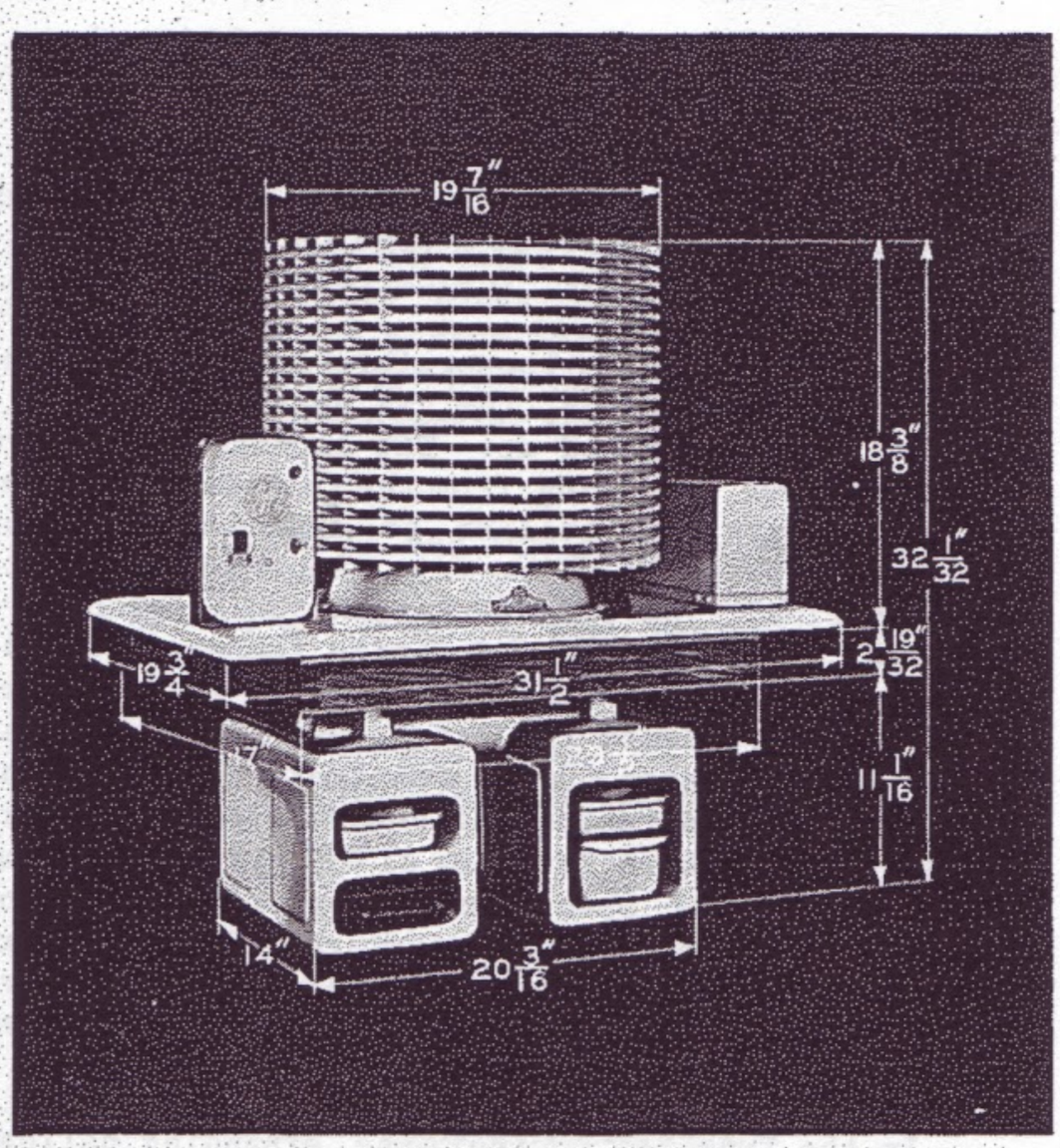


Fig.46 D-40-B16 *D-40-B16* D-40-B16
D-40-C16 and D-40-D16 similar to D-40-B16

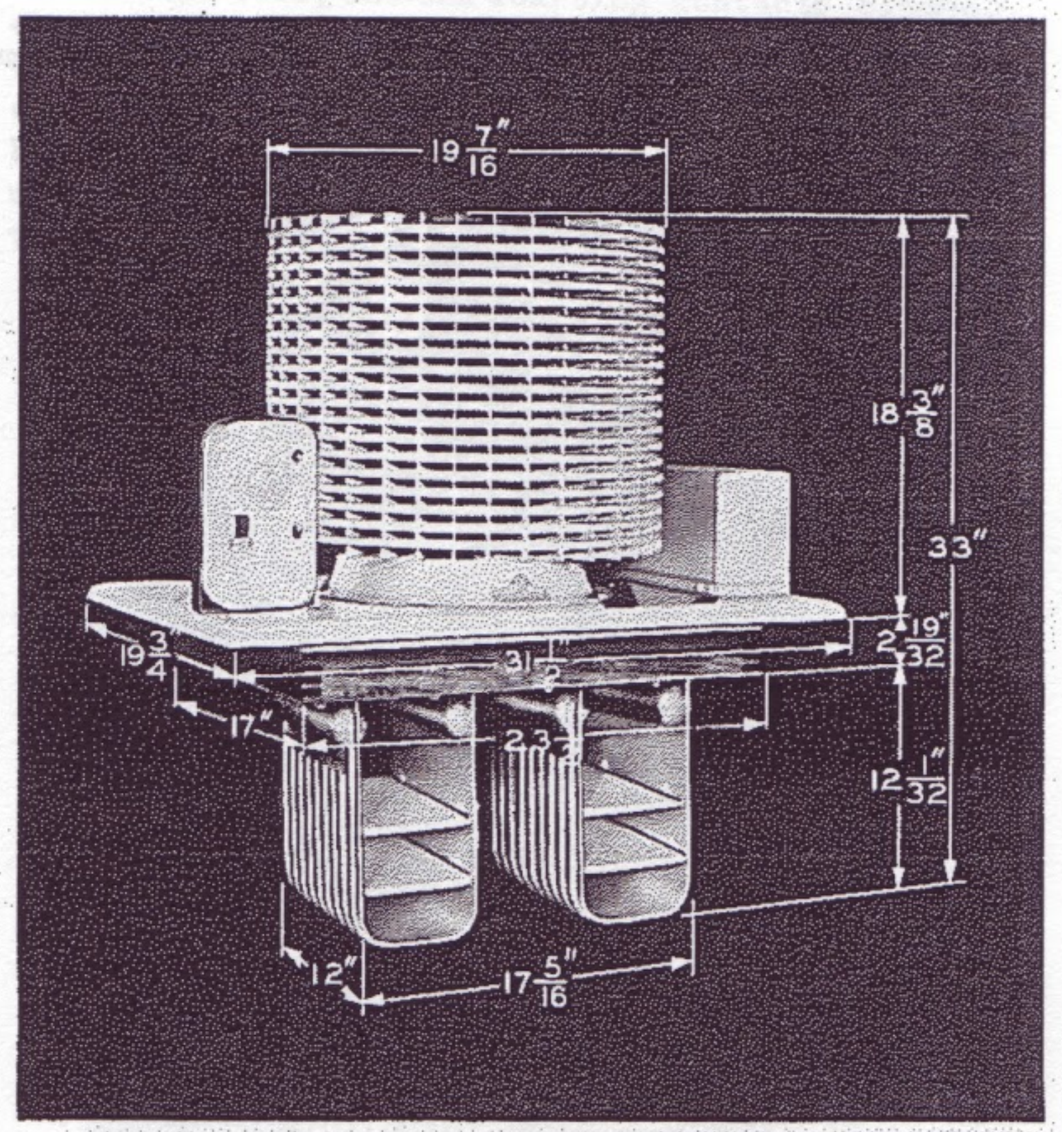


Fig.47 D-40-E16 *D-40-E16* D-40-E16
May not have collar around compressor case weld

Controls and Control Adjustments

DESCRIPTION AND OPERATION

All Type "DR" refrigerating machines are equipped with a control mechanism located on the left rear corner of the cabinet top. Although four different designs of controls are used, they are all known as CR-1050 controls, with the form letters A, C, D, or E designating the four types. Pictures of the various controls are shown on the following pages.

The CR-1050 controls have the following functions to perform.

1 Maintain proper cabinet temperatures by automatically turning the machine on and off.

2 Provide a manual "On" and "Off" switch.

3 Except the Type "A" control, all provide an external means of adjusting cabinet temperatures and freezing speeds.

4 Automatically connect into the circuit the starting winding of the motor during the starting period.

5 Provide overload protection for the motor.

TEMPERATURE CONTROL

To control cabinet temperatures a flexible me-

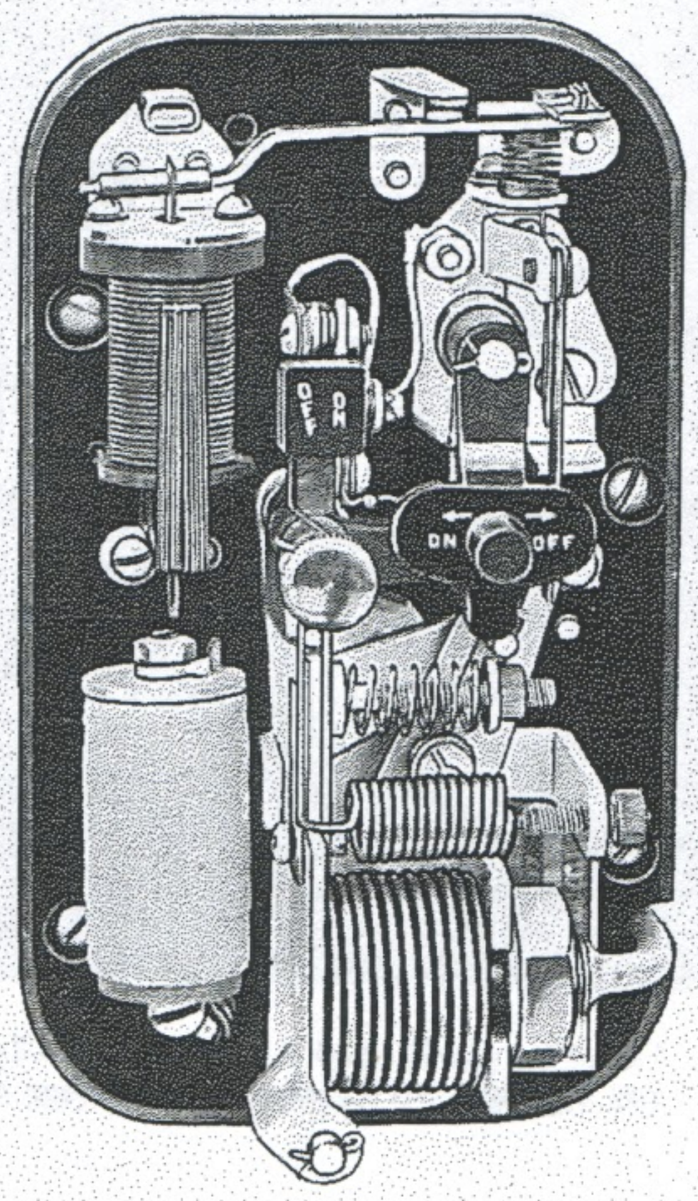


Fig.49 Type CR-1050-A-1 Control

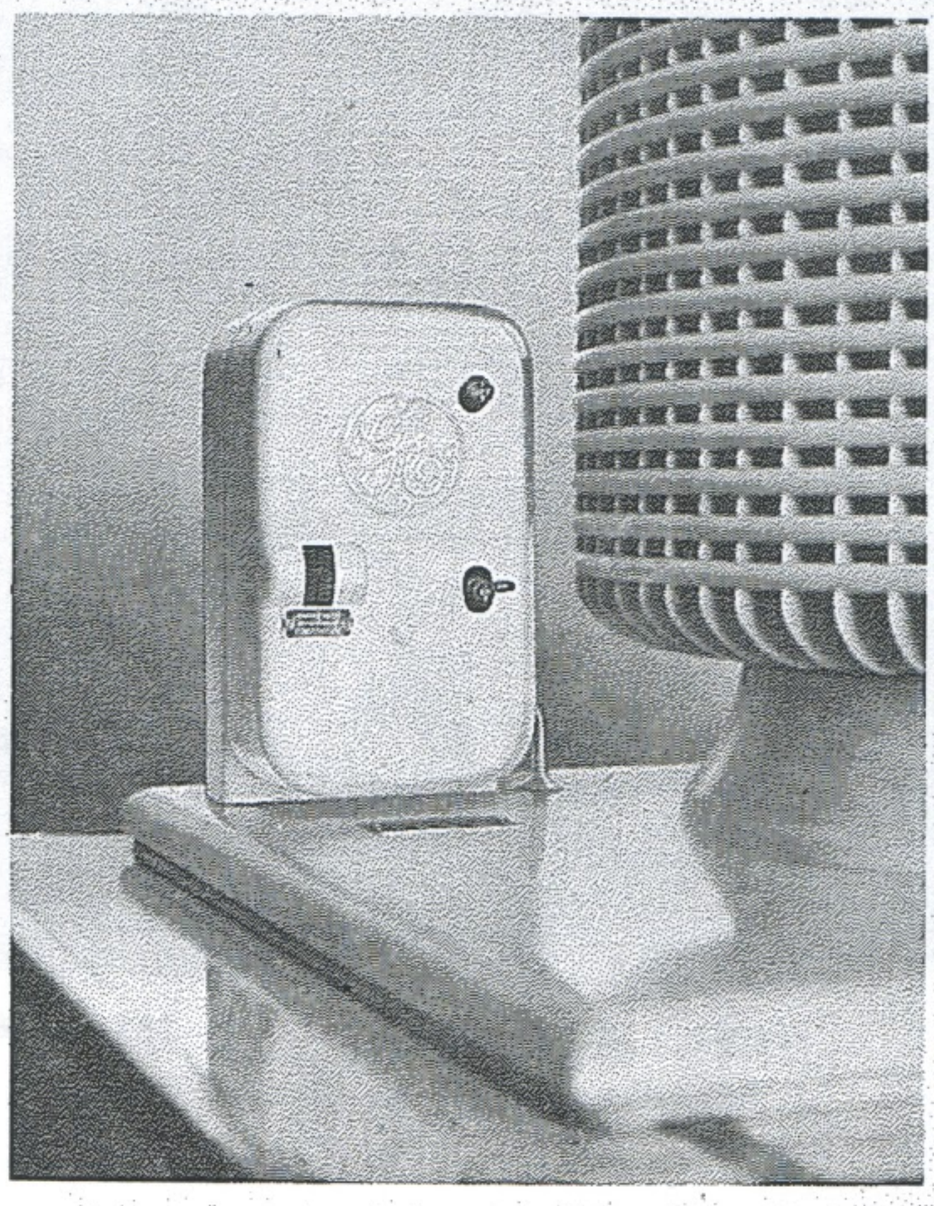


Fig.48 Type CR-1050-C Control

tallic bellows is used. It is charged with a small amount of sulphur dioxide, and has a long tube, the end of which is sealed and clamped tightly to the evaporator, inside the cabinet.

As the cabinet air temperature increases, warming up the evaporator, the gas charge in the bellows is also warmed up. The increased pressure of the vapor resulting from the increased temperature, causes the bellows to expand against the opposing pressure of the main temperature adjusting spring. The extent of expansion is predetermined, depending upon a definite temperature rise of the bellows bulb and evaporator. This bellows expansion releases the latch, or bridle mechanism, which closes the main contacts and starts the machine. A corresponding contraction of the bellows, caused by a lowering of the evaporator temperature, will open the contacts. The control limits the evaporator temperature to definite maximum and minimum points, and the evaporator operating between these limits controls the cabinet temperature.

In the Type "A" control the expanding bellows operates the main contacts through a "latch" mechanism which allows "snap action" of the contacts. This snap action is essential if the contacts are to stand up under continued usage. In the Types C, D, and E controls, snap action is obtained by a bridle and bridle spring assembly.

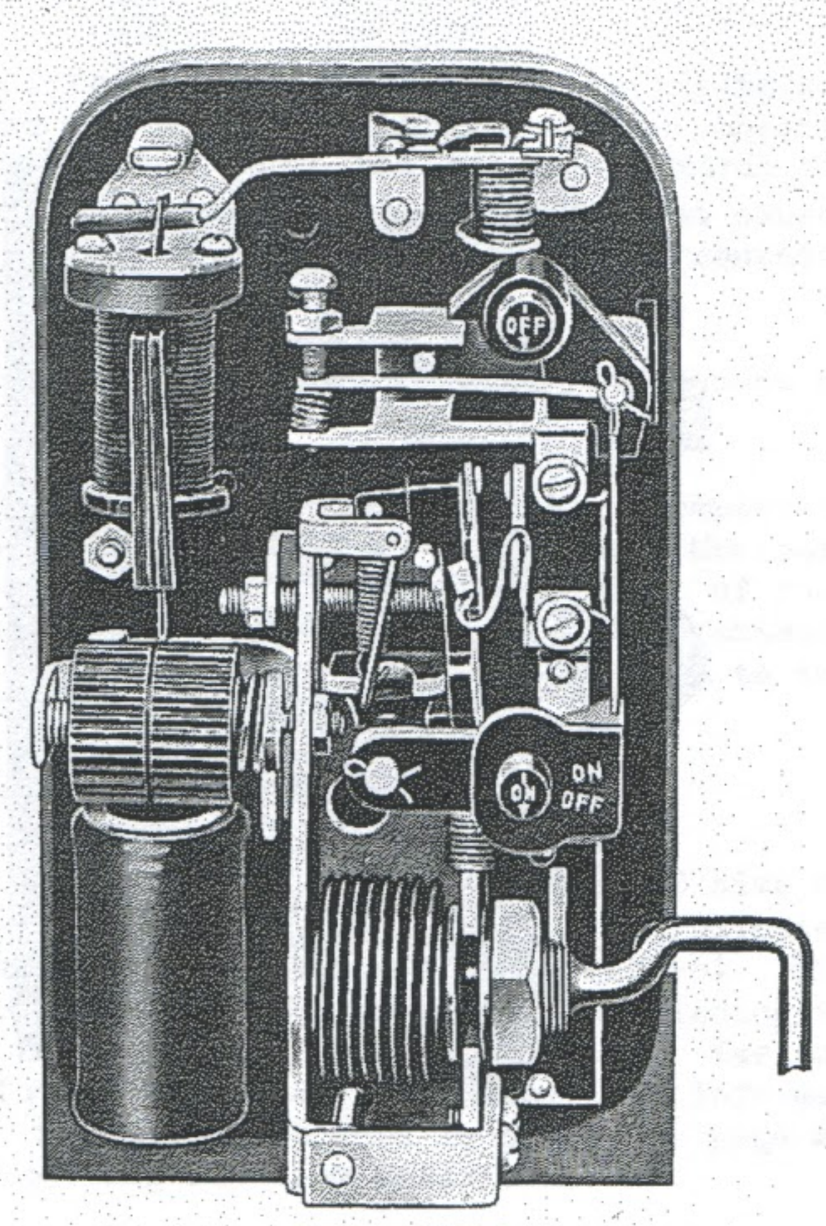


Fig.50 Type CR-1050-C-1 Control

STARTING RELAY

On all DR-1 and DR-2 size machines for 60 cycle operation (that do not have capacitors) the motor starts as a split phase motor with the starting winding in parallel with the running winding, and then continues to run as a single phase motor on the running winding only. The starting relay automatically makes these connections. The full starting current passes through the series coil, and this relatively high current sets up a magnetic force which operates the starting relay armature.

In the Type "A" and "C" controls this starting relay armature picks up, leaving the starting arm free to move and a spring then forces the arm up,

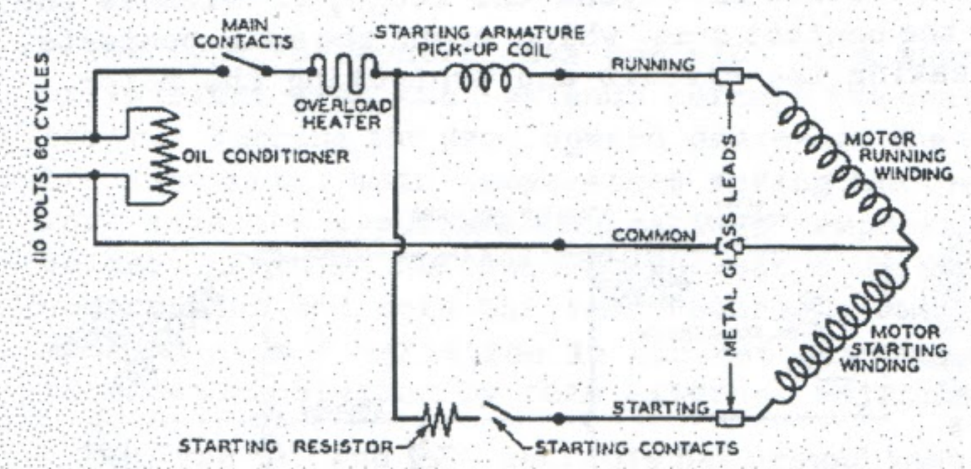


Fig.51 Schematic Wiring Diagram for machines with CR-1050-A-1, C-1, & D-1 Controls

closing the starting contacts. As can be seen from the wiring diagram, this closes the starting circuit and the starting winding is in parallel with the running winding. As the motor comes up to speed the motor current decreases, reducing the magnetic force on the relay armature which finally drops due to its own weight. This pulls the starting arm down, opening the starting contacts and the starting winding circuit. The motor then continues to run single phase on the running winding only.

The Type "D" control has a slightly different coil and starting arm arrangement since the control is mounted flat on the cabinet top. However, the same operation is performed. As the armature picks up, the starting arm is left free to be raised by a spring and close the contacts.

A somewhat different arrangement is used in the Type "E" control to properly connect the starting winding. Two coils are utilized; one a series coil and the other a shunt coil which is connected directly across the starting winding. A flapper type armature extends across the tops of both coils and is pivoted between them. The armature is so balanced that it is normally resting on the core of the series coil and the starting contacts are normally closed (when no current is being supplied.) The relatively high starting current through the series coil causes sufficient magnetic force to keep the armature down on the core of the series coil, and the starting contacts closed, during the starting period As the current decreases, the magnetic pull from the series coil decreases, and finally the magnetic force set up by the shunt coil is great enough to pull the armature down. The shunt coil is energized by a voltage generated in the starting winding of the

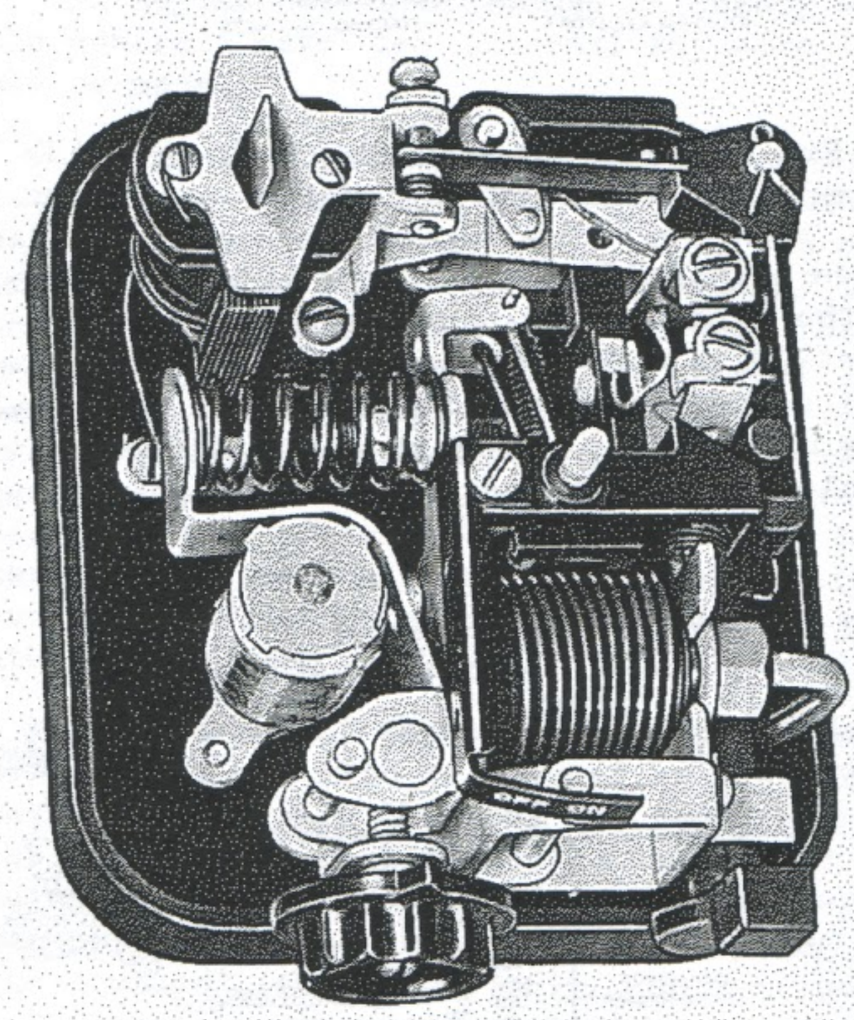


Fig.52 Type CR-1050-D-1 Control

motor. Since the armature is pivoted between the coils, it is raised from the top of the core of the series coil and this movement opens the starting contacts through an arm, extending out from the armature, that bears on the spring backed starting contact arm.

DR-3 AND 4 SIZES AND 25 CYCLE MACHINES

On DR-3 and 4 sizes and 25 cycle machines there is a capacitor in series with the starting winding and the starting winding and capacitor remain in the circuit during the running period. One point of the capacitor is in the circuit on starting and when the starting relay opens the starting contacts, the movement of the starting arm acts to close a second set of contacts mounted on the opposite side of the starting arm. This connects another point of the capacitor in the circuit and the machine then continues to run as a poly phase motor with the running contact of the capacitor in the circuit.

The Types A, C and E controls were all used on these machines, and the wiring diagrams show the electrical circuits.

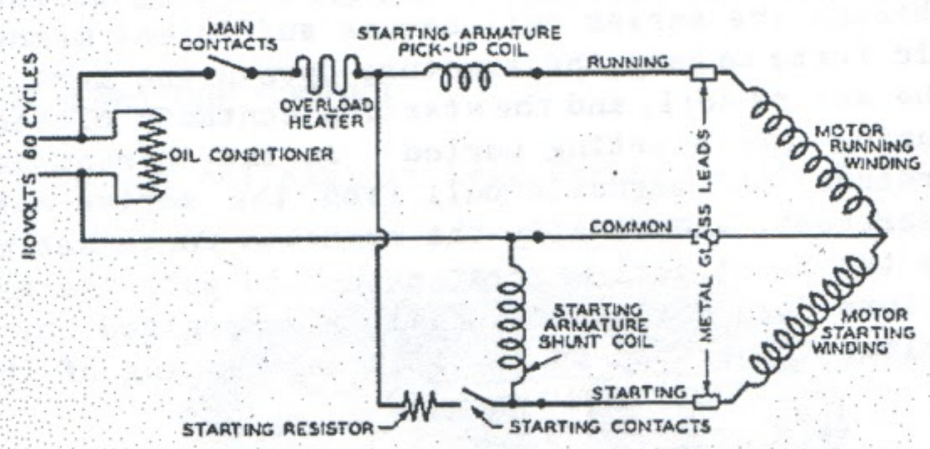


Fig.54 Schematic Wiring Diagram for machines with CR-1050-E-1 Controls

On the standard DR-3 and 4 sizes of 60 cycle machines the capacitor is permanently mounted on the cabinet top in back of the condenser, and the electrical connections from the capacitor are permanently fastened on in the back of the control. On the 25-cycle machines the capacitor is separate and

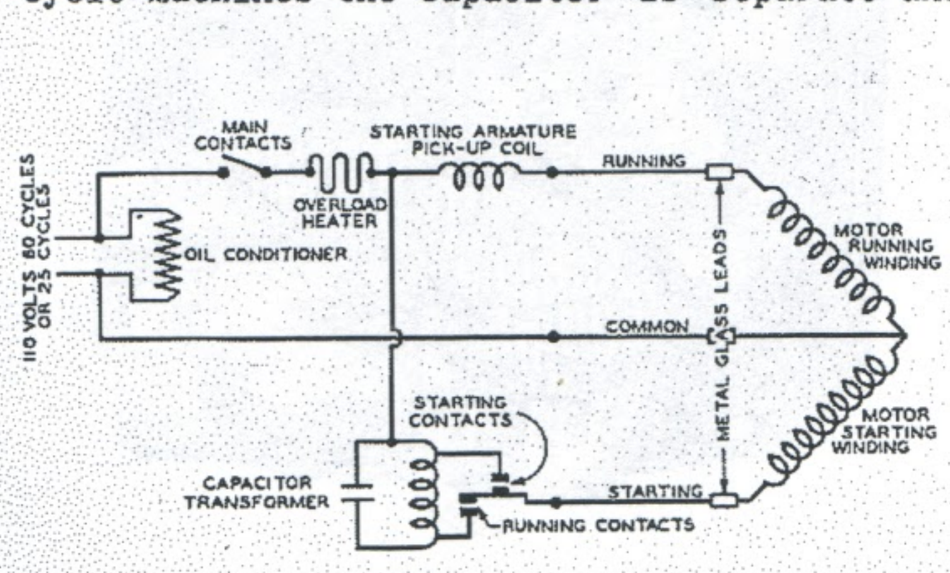


Fig.55 Schematic Wiring Diagram for machines with CR-1050-A-2 A-4 & C-2-4-5-6-10-15-18 Controls

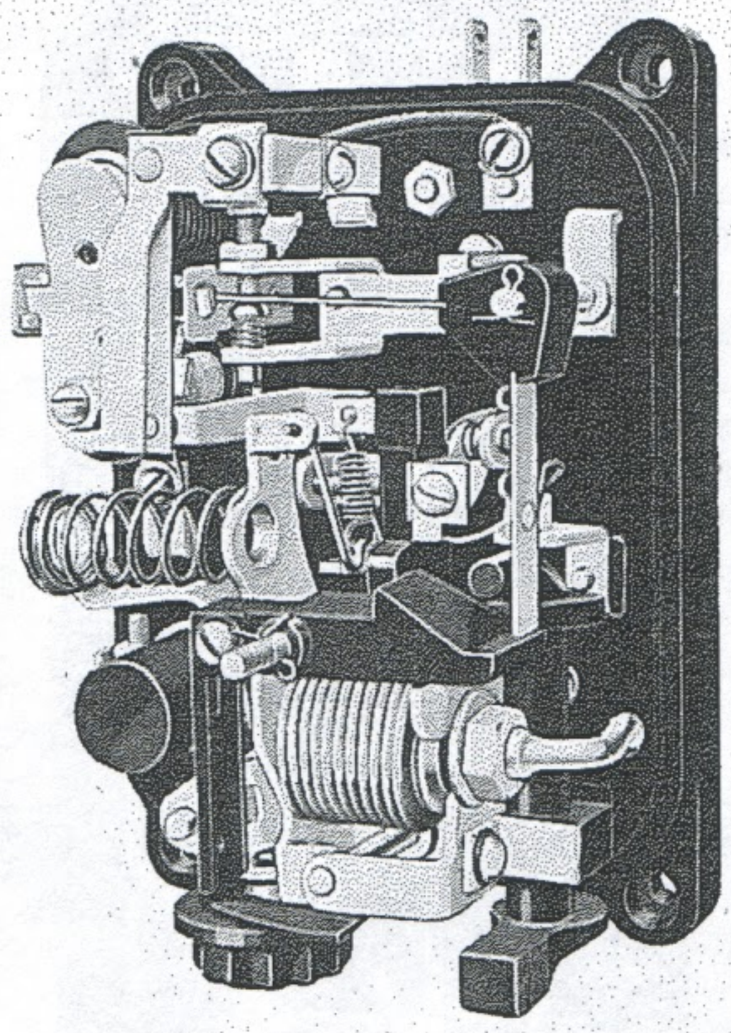


Fig.53 Type CR-1050-E-1 Control

connection is made by plugging the cord attached to it into a three-way receptacle on the back of the control, or on the cabinet top at the base of the control.

OVERLOAD PROTECTION

All the controls provide overload protection to the motor, by means of a bimetallic strip and resistance heater. The full line current flows through the heater which is mounted parallel to the bimetallic strip. Excessive current produces enough heat to cause the strip to flex outward. With the main control contacts closed and the motor running normally, the bimetallic strip rests on a ledge of the latch arm, and prevents the contacts from opening.

In the Type "A" control, when the bi-metallic strip flexes out beyond the ledge, it releases one of the contact arms, which opens the main contacts, breaking the circuit and protecting the motor.

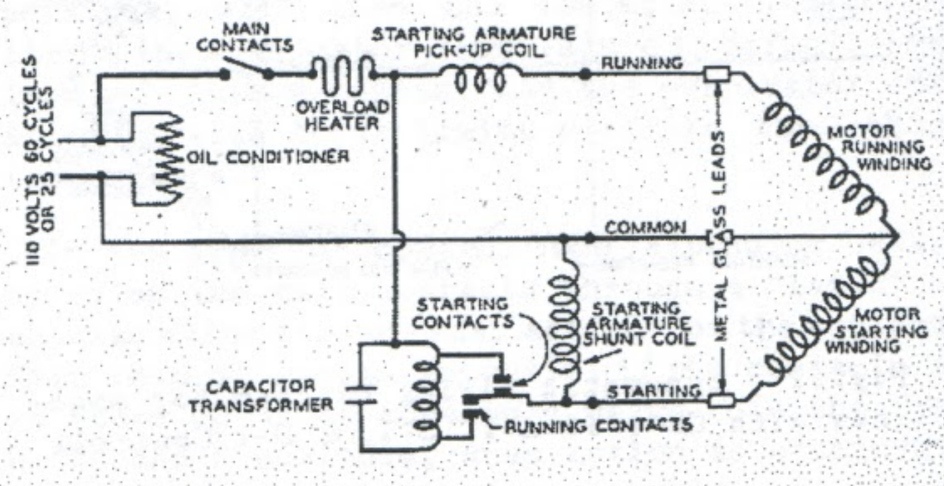


Fig.56 Schematic Wiring Diagram for machines with CR-1050-E-2 Controls

In the Type C, D, and E controls, a spring-backed latch arm is released and acts on the movable main contact arm, when the bimetallic strip has flexed out beyond the ledge. This movement caused by the small latch spring, causes the main contacts to be opened.

To restart the machines the main switch must be turned on manually.

On all controls except the Type "A", a compensating bimetallic strip is provided to make the operation of the overload device independent of room temperatures. This compensating strip extends from the pivot point of the overload strip to the overload adjusting screw.

RESISTORS

On all controls for the DR-1 and DR-2 size 60 cycle machines an external resistor of approximately 6 ohms is incorporated in the control. The resistor is in series with the starting winding to obtain the required starting torque. Various types of resistors were used and complete information on the different ones is given on page 29 under Replacing Starting Resistors.

EXTERNAL TEMPERATURE ADJUSTMENTS

All the controls have an external "Off" and "On" switch with the two positions being indicated by the proper words appearing in a window of the control cover. Turning the switch to "Off" manually, trips the overload device which allows the main contacts to open. Turning the switch to "On" resets the overload, closing the main contacts.

The Type "A" control does not have any external temperature adjustment. Cabinet temperature adjustment of the Type C, D, and E controls is obtained by externally changing the force of the main temperature adjusting spring that balances the pressure of the bellows. If the spring force is reduced, the bellows tube and hence the evaporator do not have to be at as high a temperature to produce the same bellows expansion necessary to operate the main contacts and start and stop the machine. Therefore, the evaporator and cabinet are maintained at a colder temperature.

The Type "C" control has one side of a knurled cylindrical drum that extends through the control cover. Turning the drum upward decreases the compression on the main temperature spring and therefore sets the evaporator and cabinet temperatures colder. Turning the drum down increases the spring compression and sets the temperatures warmer. A maximum of 4 F variation in cabinet air temperature can be obtained by this external adjustment.

The Type "D" and "E" controls have round knobs on the control front with an indicating pointer. Turning the knob to the left decreases the evaporator and cabinet temperatures, and turning it to the right increases the temperatures. A maximum of 12 F variation is obtainable by the external adjustment.

DIRECT CURRENT

All of the four Types A, C, D and E controls are made up for direct current operation and these are illustrated in the photographs later in this discussion. All machines designed for operation on direct current are supplied with current from a rotary converter. The motors used in these machines are always for alternating current, and the converters furnish alternating current converted from the d-c supply. The smaller machines use a 2-phase motor and the larger machines use a 3-phase motor.

Since these machines operate through a converter the starting relay mechanism is eliminated from the controls. The resistor is also eliminated. As can be seen from the pictures, only the temperature control mechanism and overload device is used.

Note – More complete information on direct-current and odd frequency machines and controls for these machines is given on page 43 in the section on Direct Current and Odd Frequency Machines.

Adjustments

Caution: Whenever making adjustments disconnect power supply.

INTERNAL TEMPERATURE ADJUSTMENTS

All controls except the Type "A" have manual external adjustments for the customer's use as explained in a previous section. However, additional adjustment is sometimes necessary and all the controls have two internal adjustments that can be made.

Changing the tension or compression of the main temperature spring, which is balanced against the bellows pressure, changes both the "cut on" and "cut off" temperatures of the control, keeping the differential between them the same. *Decreasing the tension or compression of the spring results in colder evaporator temperatures. Increasing the tension or compression results in warmer evaporator and cabinet temperatures.* An easy way of remembering this is that with no temperature spring or minimum tension the machine will run all the time and maintain the coldest temperature.

The differential between the "cut on" and "cut off" points can also be changed by an adjustment which affects only the "cut on" temperature. On the Type "A" control there is a temperature range adjusting spring that determines the differential and decreasing the tension of this spring lowers the "cut on" temperature only. On the Type C, D, and E controls the differential is determined by the gap between the main contacts. A temperature differential adjusting screw limits the movement of the movable main contact as it opens, and

decreasing the gap by means of the screw, lowers the "cut on" temperature.

Adjustments on the different types of controls are given below:

CR-1050-A CONTROL

(Use photograph on Page 30 for numbered references)

To Set Control Colder: Turn the main temperature adjusting screw (No.11) in a clockwise direction, which decreases the tension on the main temperature spring.

To Set Control Warmer. Turn the main temperature adjusting screw (No. 11) in a counter-clockwise direction, which increases the spring tension.

To Lower the "Cut On" Temperature: Turn the temperature range adjusting screw (No.14) in a counter-clockwise direction.

> *Caution:* Adjusting screw (No. 14) should never be backed out beyond 1/4 inch from the end of the stud.

To Raise the "Cut On" Temperature: Turn the temperature differential adjusting screw (No. 14) in a clockwise direction so as to increase the tension on the differential adjustment spring.

CR-1050-C CONTROL

(Use photograph on Page 34 for numbered references)

To Set Control Colder: Turn the knurled temperature adjusting nut (No. 23) so that it moves towards the operating lever and the compression on the main temperature adjusting spring is decreased.

To Set Control Warmer: Turn the knurled temperature adjusting nut (No. 23) so that it is screwed away from the operating lever and the compression on the spring is increased.

To Lower the "Cut On" Temperature: Loosen the lock nut on the temperature range adjusting screw (No. 14) and turn the screw in so that the main contact gap (contacts open) is decreased.

> *Caution:* The gap should never be adjusted to less than 1/16 inch.

To Raise the "Cut On" Temperature: Loosen the lock nut on the temperature range adjusting screw (No. 14) and turn the screw out so that the main contact gap (contacts open) is increased.

> *Caution:* The gap should never be adjusted to more than 1/8 inch.

CR-1050-D AND CR-1050-E CONTROLS

(Use photographs on Pages 38 and 40 for numbered references.

To Set Control Colder: The temperature adjusting knob must be reset so that when the indicating pointer is in the same position as before, the lead screw is actually turned farther to the left resulting in less compression on the main temperature spring.

1 Set the control knob at mid-position.
2 From mid-position turn the knob in the colder direction or to the left the number of positions that it is desired to reset the control colder.
3 Remove the screw which holds the knob in place and remove the knob.
4 Replace the knob with it set at mid-position.

To Set Control Warmer: This is done in the same manner as above, with the exception that from the original mid-position setting, the knob is turned in the warmer direction or to the right the number of positions it is desired to reset the control warmer. Then when the knob is removed and replaced with it set at mid-position, the result is that the lead screw is actually turned farther to the right and the compression of the temperature spring has been increased.

> *Note* - An approximate mid-position normal temperature setting is obtained when the end of the bellows lever arm bisects the terminal screw in the control base just below the main spring.

To Lower the "Cut On" Temperature: Loosen the lock nut on the temperature range adjusting screw and turn the screw in so that with the main contacts open, the gap between them is decreased.

> *Caution:* The gap should never be adjusted to less than 1/16 inch.

To Raise the "Cut On" Temperature: Loosen the lock nut on the temperature range adjusting screw and turn the screw out so that with the main contacts open, the gap between them is increased.

> *Caution:* The gap should never be adjusted to more than 1/8 inch.

OVERLOAD ADJUSTMENTS

The overload setting is determined by the distance the end of the bi-metallic strip is from the edge of the latch arm on which it rests, or in other words, by the distance the end must flex outward to release the latch.

CR-1050-A Control: The overload adjusting screw No. 20 - Photograph on Page 30 is loosened and the overload adjusting plate No. 19 is moved *slightly* to the *left* to *increase* the tripping time, and to the *right* to *decrease* the tripping time. Screw No. 20 must be securely tightened after an adjustment, and the tripping time should be checked. With the machine running and the starting contacts closed, the overload should trip between 15 and 25 seconds.

CR-1050-C, D and E Controls: Loosen the lock nut

on the overload adjusting screw (No 21 - Photograph on Pages 34, 38, 40) and turn the screw *up* to *increase* the tripping time and screw it *down* to *decrease* the tripping time. The lock nut should then be tightened and the following checks made:

Type "C" Control: The clearance between the heater wire and the bi-metallic strip should be about 1/32 inch. The space between the edge of the latch arm and the strip should be about 1/32 inch. With the starting contacts held closed the overload should trip between 15 and 25 seconds.

Type "D" Control: The clearance between the heater and the strip should be about 1/32 inch. The space between the edge of the latch arm and the strip should be about 1/64 inch. With the starting contacts held closed the overload should trip between 12 and 18 seconds.

Type "E" Control: With the starting contacts held closed the overload should trip between 15 and 25 seconds. The clearance between the heater and the strip is permanently adjusted. The space between the edge of the latch arm and the strip should be about 1/32 inch or about the thickness of the strip.

Caution: Never adjust the overload so that it will not trip out within the proper limits, as damage may result to the machine. If the overload continues to trip with the proper setting, the machine should be checked for some other trouble and the condition corrected.

Note - If, when adjusting the overload, it is found that it does not trip properly, examine the ledge of the latch and reset arm on which the bi-metallic strip rests. If the strip has worn a groove in the compound, smooth it down with a fine file or replace the arm. Also make sure that the end of the strip is smooth.

REPLACING THE METALLIC BELLOWS

A weak or flat bellows can best be determined by warming up the bellows tube. The bellows should expand and if it does not and can be compressed easily with the fingers, it has lost its charge.

All replacement bellows are shipped in a clamp that prevents them from expanding.

Caution: Never remove the shipping clamp from a bellows when it is warm. It must be cooled down before the clamp is removed.

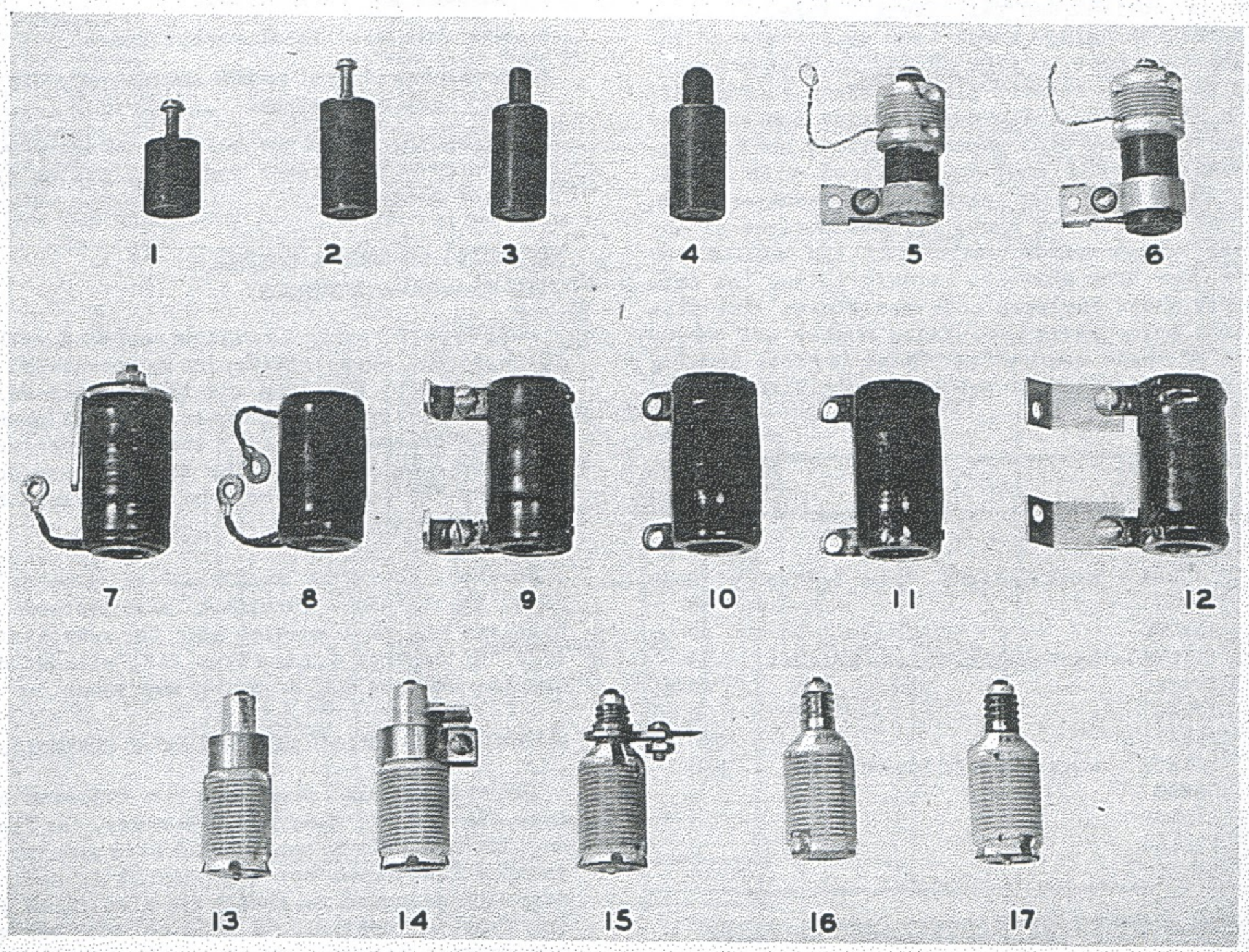


Fig.57 Starting Resistors

The procedure is as follows:

1 Loosen the control from the cabinet top.

2 Remove the control cover and loosen the large clamp nut on the bellows.

3 Remove the clamp that holds the bellows tube to the evaporator.

4 Straighten the bellows tube and pull it through the cabinet top.

5 Push the new bellows tube (with the bellows still in its clamp) through the cabinet top.

6 Chill the end of the bellows tube by holding it against the evaporator, with the machine running, or by immersing it in an ice and salt mixture, or by using dry ice.

7 Remove the shipping clamp from the bellows and insert the bellows in the control.

8 Tighten the bellows clamp nut.

9 Attach the control on the cabinet top, and clamp bellows tube to the evaporator.

10 Check the temperature adjustment after the machine has run long enough to be cycling normally.

REPLACING STARTING RESISTORS

All the starting resistors used in the various controls can be replaced. The method of replacement is obvious and relatively simple, although when interchanging a screw base type resistor for a plug type base, or vice versa, it will be necessary to use an adaptor plate as shown in Fig. 57, parts 14 and 15. The copper oxide and combined copper oxide and wire wound resistors are no longer available and must be replaced with either blue enamel or open wire wound resistors. In Fig. 57 the top row shows various designs of obsolete copper oxide resistors, the middle row shows the blue enameled resistors, and the bottom row shows the open coil resistors. The tabulation below gives the catalog number and resistance of these resistors. Refer to Parts Catalog for identification of the resistors with the various controls.

No	Resistor Cat. No.	Resistance Ohms
1-6	Obsolete	--
7	11x18	3.4
	11x24 - same as 11x18, less bracket	3.4
8	11x23	6
9	11x255	10
	11x246- same as 11x255 less bracket	10
10	11x79	3.4
11	11x80	6
12	11x77	350
	11x78 - same as 11x77 less bracket	350
13	58x30	6
14	11x529	6
16	11x480	6
17	58x31	10

REPLACEMENT OF MISCELLANEOUS PARTS

Practically all the individual parts of the Type A, C, D and E controls are replaceable in the field. No information, other than that printed on the preceding pages, need be given as to the method of replacing the various parts, since in all cases, the construction is obvious and simple. It is not recommended that coils or armature of the Type "E" controls be replaced or adjusted.

Care should be taken to see that the proper parts are used in the different controls, and that the final adjustments are properly made.

REPLACING CONTROL PANELS

REPLACING CR-1050-A AND CR-1050-C CONTROLS:

1 Remove the screws holding the control to the cabinet top and those securing the back of the panel.

2 Disconnect all wires leading to the control.

Caution: If the color of any lead is not easily distinguishable, mark such a lead carefully before changing the control.

3 Loosen the bellows tube clamp on the evaporator, straighten the tube and pull it through the cabinet top.

4 Insert the bellows tube of the new control through the cabinet top.

5 Make all electrical connections.

6 Mount the control on the cabinet top and assemble back on control.

7 Clamp the end of the bellows tube to the evaporator in its proper position, making sure of good contact.

REPLACING CR-1050-A CONTROLS WITH CR-1050-C CONTROLS:

Most Type "A" controls will be replaced with Type "C" controls when replacement is necessary. This can be done by drilling and tapping two holes in the cabinet top to take the screws that mount the Type "C" control. It will then be necessary to touch up a small area of the top that was covered with the "A" control, but is not covered by the Type "C" control.

However, there is available an adapter plate (Cat. No. 11X984) furnished with screws and a bakelite nut that enables you to substitute the Type "C" control for the Type "A", without drilling the cabinet top or doing any touch up work.

REPLACING CR-1050-D AND CR-1050-E CONTROLS:

The same general procedure is followed as for Type "A" and "C" controls. However, the Type "D" and "E" controls do not have any back panels, being mounted flat on the box top, and it is not necessary to disconnect or change any electrical leads. The Type "D" control is held to the box top by two contact screws. The Type "E" control is held by four screws in the corners of the control base.

CR-1050-A-1 CONTROL - 60 CYCLE, 110 VOLTS

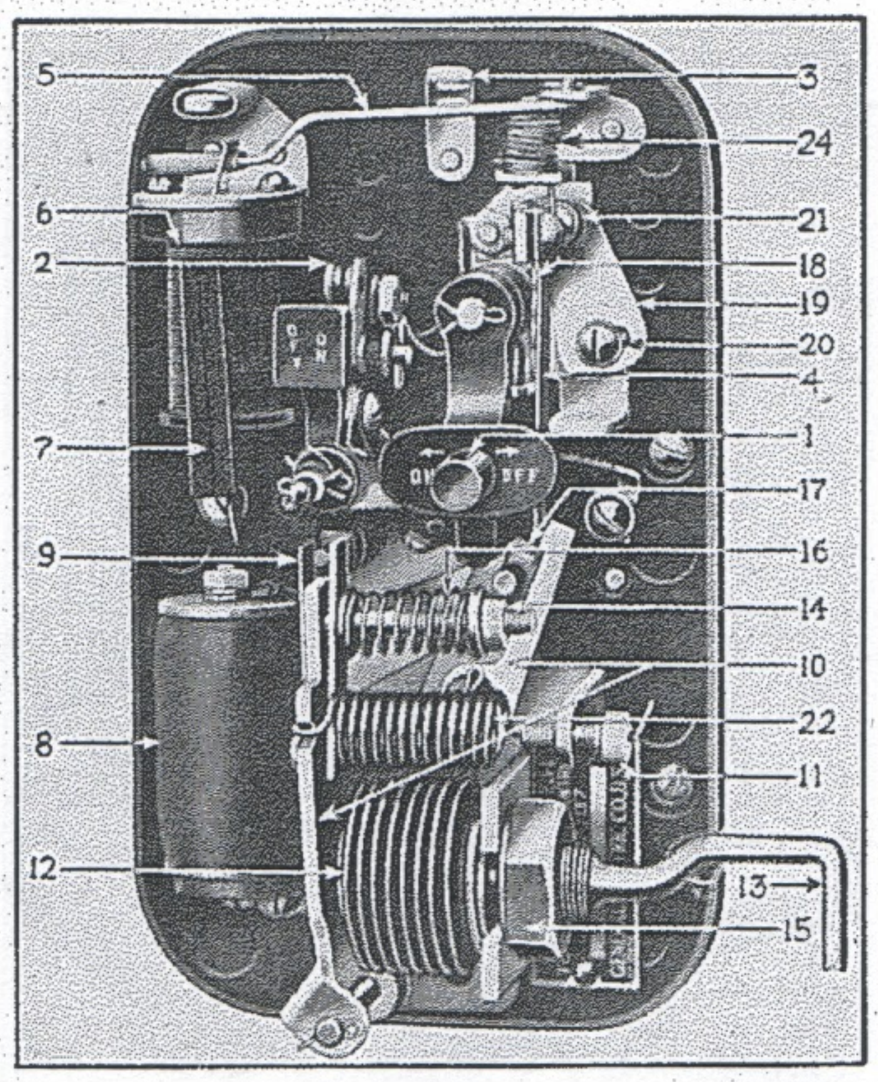


Fig. 58 Front View

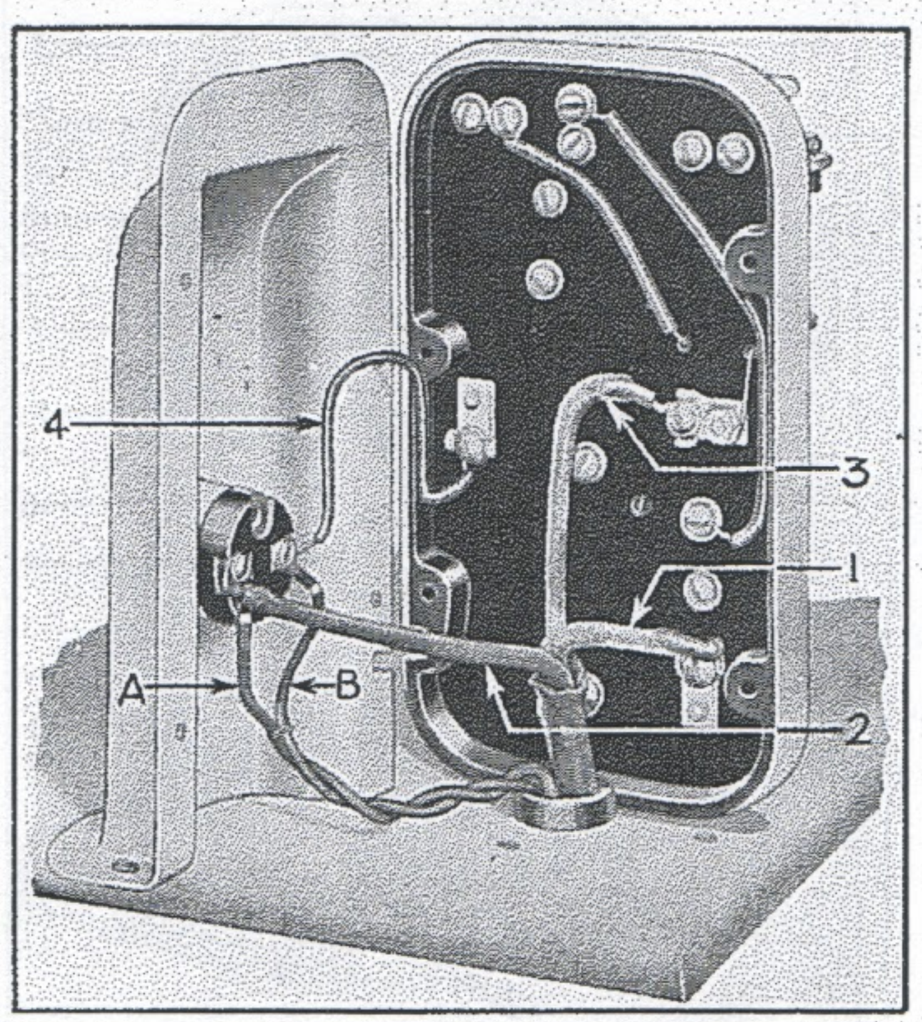


Fig. 59 Back View

1 Main Switch
2 Main Contacts
3 Starting Contacts
4 Overload Cut-out
5 Starting Relay-Contact Arm
6 Starting Relay Coil
7 Starting Relay Armature
8 Starting Resistor
9 Leaf Spring
10 Latch mechanism
11 Temperature Adjustment
12 Metallic Bellows
13 Bellows Tube to Evaporator
14 Temperature Range Adjustment Screw
15 Clamp Nut on Bellows
16 Temperature Range Adjustment Spring
17 Inner Latch Arm
18 Overload Heater
19 Overload Adjustment Plate
20 Overload Adjusting Screw
21 Overload Adjusting Screw
22 Temperature Adjustment Spring
24 Starting Arm Spring

1 Short White Lead - Starting Winding
2 Medium Length Black Lead - Common Connection
3 Long Red Lead - Running Winding
4 Main Line Connection
A-B - Oil Conditioner Leads

MOTOR CONNECTIONS	
Lead	DR-2 Machines
Running	Red or Green
Common	Black
Starting	White

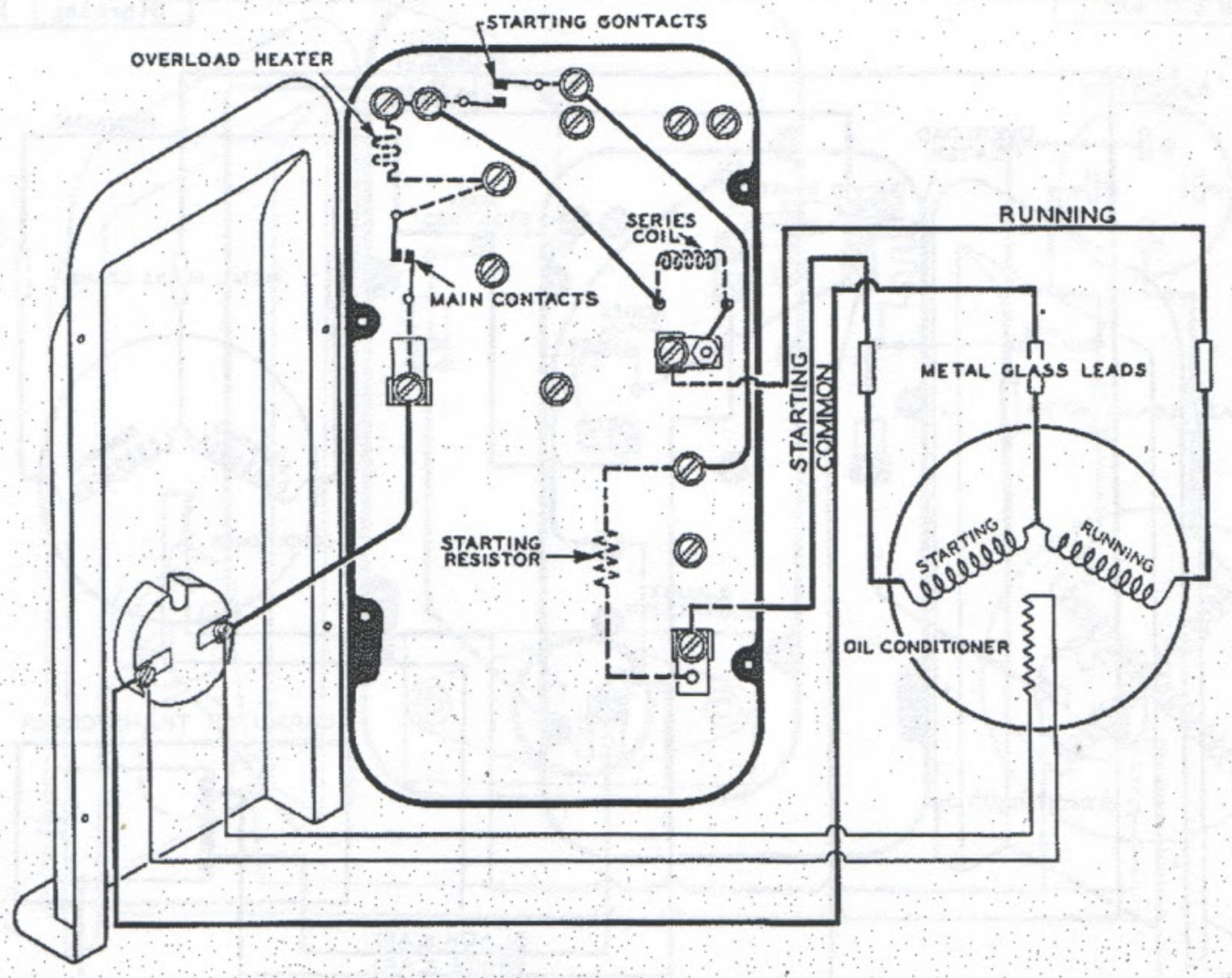


Fig. 60 Connection Diagram See Fig. 51 for Schematic Wiring Diagram

CR-1050-A-2 CONTROL - 60 CYCLE, 110 VOLTS

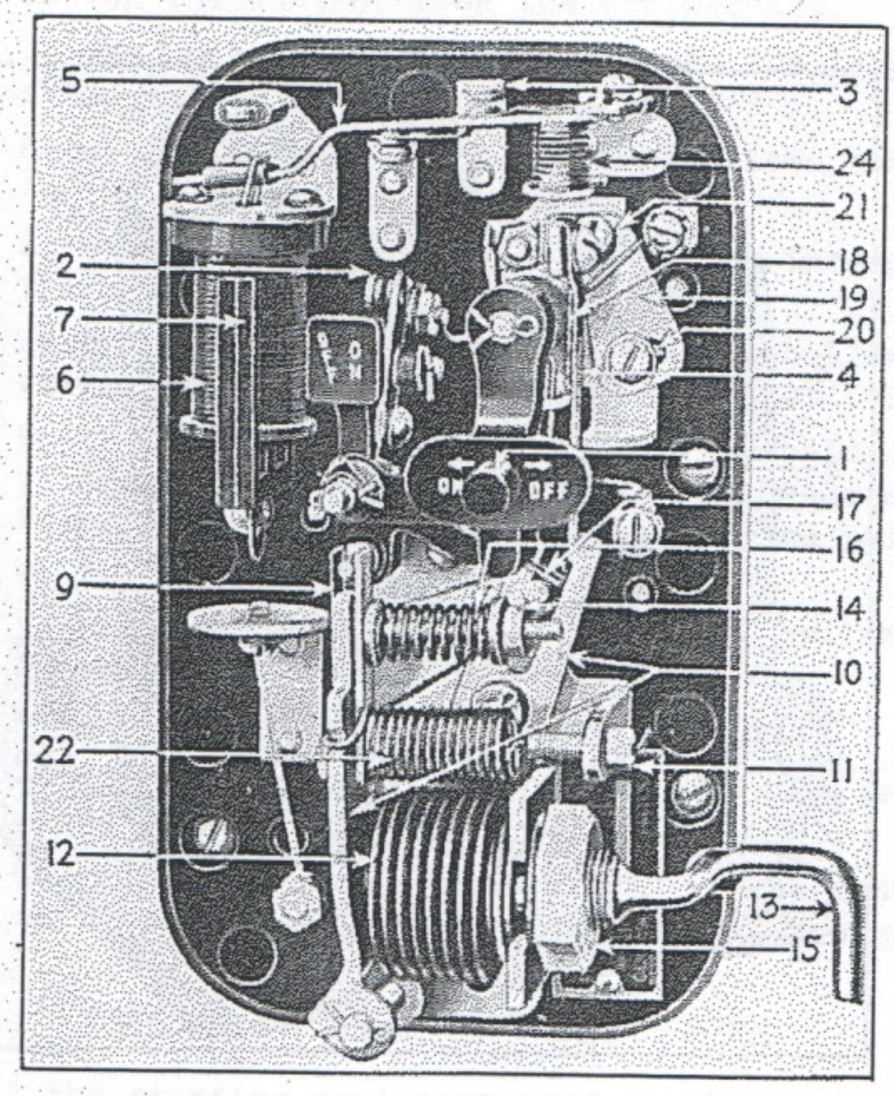


Fig. 61 Front View

1 Main Switch
2 Main Contacts
3 Starting Contacts
4 Overload Cut-out
5 Starting Relay-Contact Arm
6 Starting Relay Coil
7 Starting Relay Armature
9 Leaf Spring
10 Latch Mechanism
11 Temperature Adjustment
12 Metallic Bellows
13 Bellows Tube to Evaporator
14 Temperature Range Adjustment Screw
15 Clamp Nut on Bellows
16 Temperature Range Adjustment Spring
17 Inner Latch Arm
18 Overload Heater
19 Overload Adjustment Plate
20 Overload Adjusting Screw
21 Overload Adjusting Screw
22 Temperature Adjustment Spring
24 Starting Arm Spring

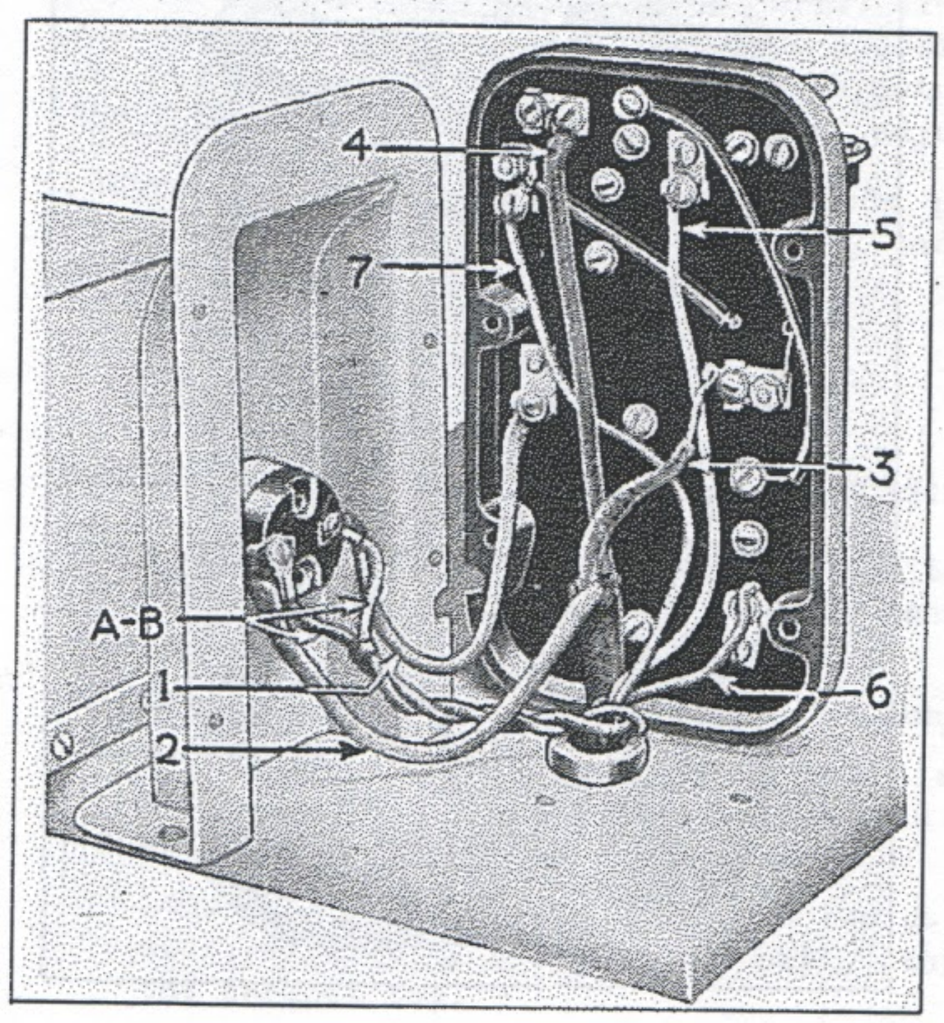


Fig. 62 Back View

1 Line Lead
2 Red, Large, Motor Lead, Common
3 White, Large, Motor Lead, Running
4 Black, Large, Motor Lead, Start
5 White, Small, Capacitor Lead
6 Black, Small, Capacitor Lead
7 Red, Small, Capacitor Lead
A-B - Oil Conditioner Leads

MOTOR CONNECTIONS	
Lead	DR-3 & 4 Mach.
Running	White
Common	Red or Green
Starting	Black

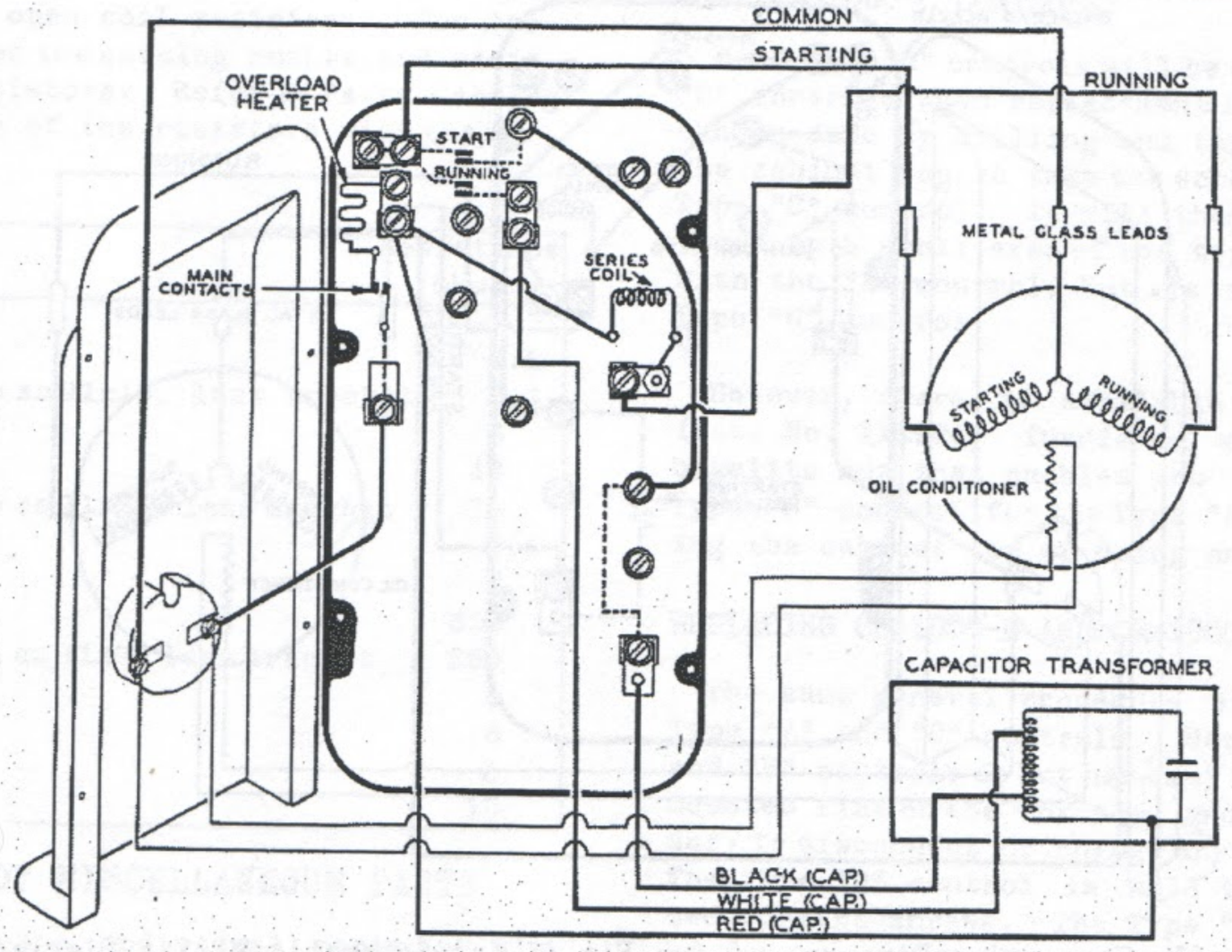


Fig. 63 Connection Diagram See Fig. 55 for Schematic Wiring Diagram

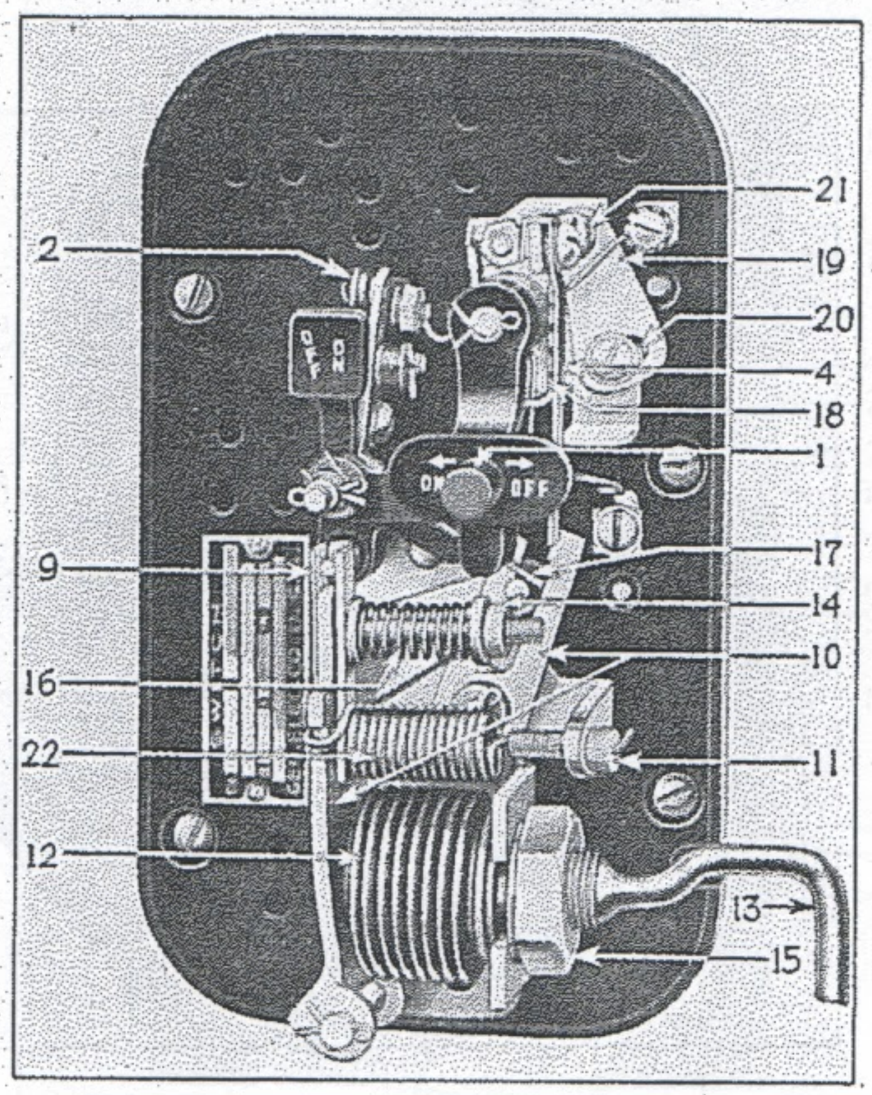


Fig. 64 Front View

1 Main Switch
2 Main Contacts
4 Overload Cut-out
9 Leaf Spring
10 Latch Mechanism
11 Temperature Adjustment
12 Metallic Bellows
13 Bellows Tube to Evaporator
14 Temperature Range Adjustment Screw
15 Clamp Nut on Bellows
16 Temperature Range Adjustment Spring
17 Inner Latch Arm
18 Overload Heater
19 Overload Adjustment Plate
20 Overload Adjusting Screw
21 Overload Adjusting Screw
22 Temperature Adjustment Spring

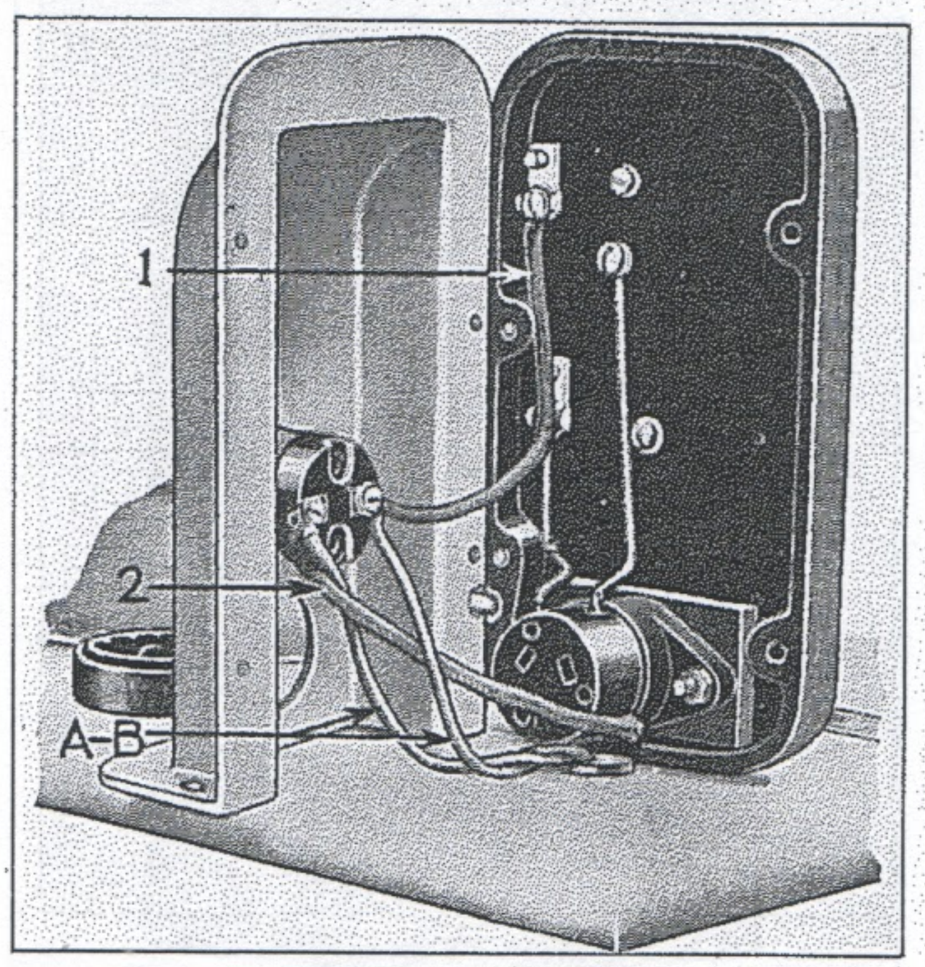


Fig. 65 Back View

1 Line Lead
2 Line Lead
A-B - Oil Conditioner Leads

MOTOR CONNECTIONS	
No.	DR-2 & 3 Mach.
1	White
2	Brown or Green
3	Black
4	Red
See D-c Section	

Fig. 66 Connection Diagram See Fig. 108 for Schematic Wiring Diagram

CR-1050-A-4 CONTROL - 25 CYCLE, 110 VOLTS

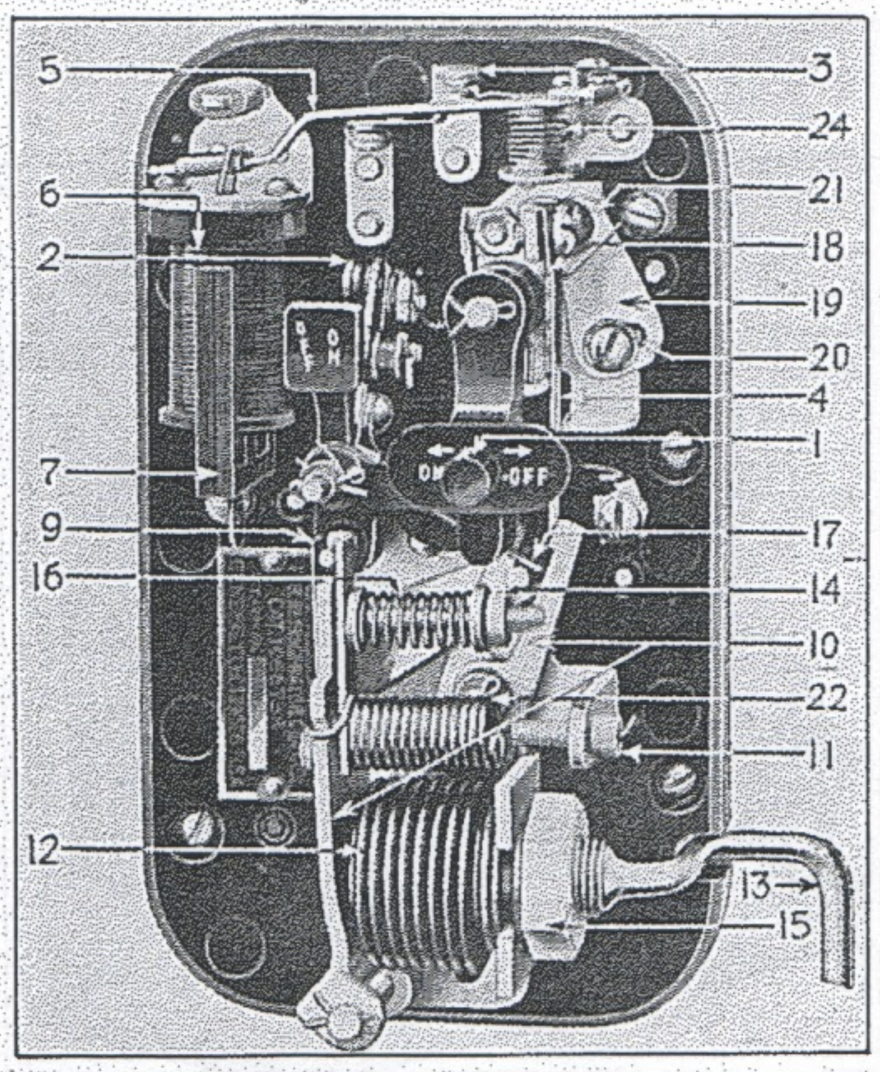


Fig. 67 Front View

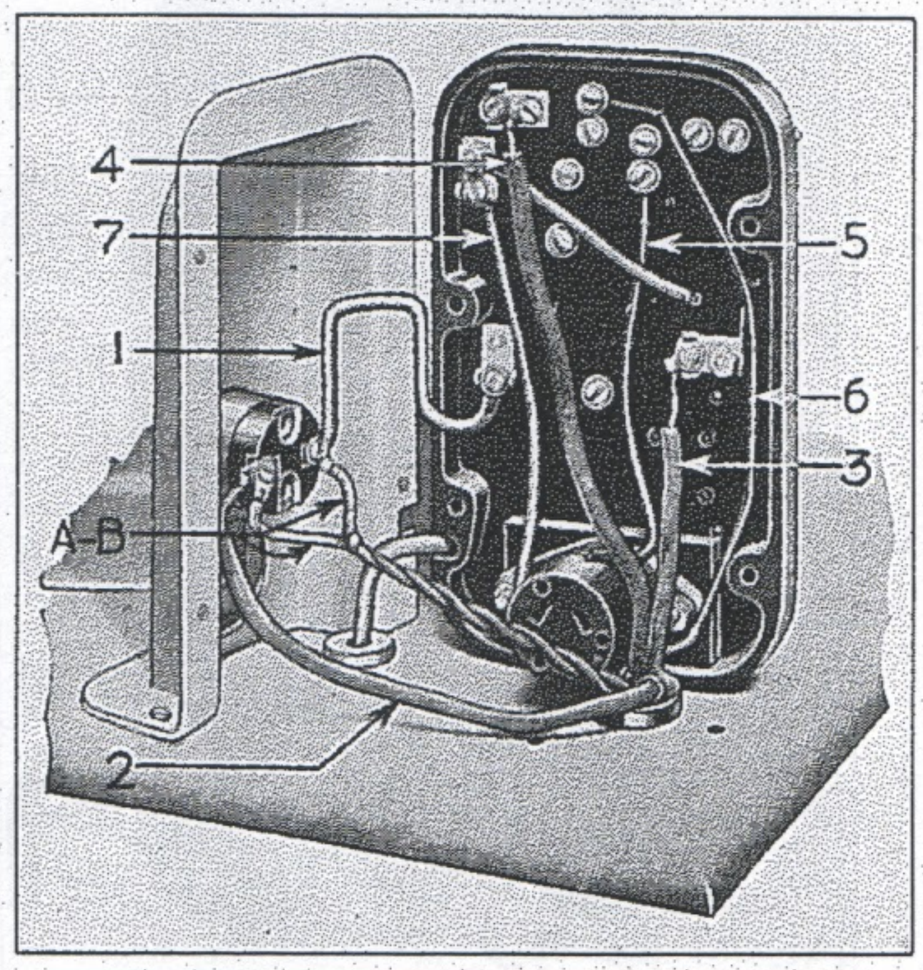


Fig. 68 Back View

1	Main Switch	
2	Main Contacts	
3	Starting Contacts	
4	Overload Cut-out	
5	Starting Relay-Contact Arm	
6	Starting Relay Coil	
7	Starting Relay Armature	
9	Leaf Spring	
10	Latch Mechanism	
11	Temperature Adjustment	
12	Metallic Bellows	
13	Bellows Tube to Evaporator	
14	Temperature Range Adjustment Screw	
15	Clamp Nut on Bellows	
16	Temperature Range Adjustment Spring	
17	Inner Latch Arm	
18	Overload Heater	
19	Overload Adjustment Plate	
20	Overload Adjusting Screw	
21	Overload Adjusting Screw	
22	Temperature Adjustment Spring	
24	Starting Arm Spring	

	For DR-2	For DR-3
1	Line Lead	Line Lead
2	Black, Large Motor Lead, Common	Red, Large, Motor Lead, Common
3	Red, Large, Motor Lead, Running	White, Large, Motor Lead, Running
4	White, Large, Motor Lead, Starting	Black, Large, Motor Lead, Starting
5	White, Small, Capacitor Lead	White, Small, Capacitor Lead
6	Black, Small, Capacitor Lead	Black, Small, Capacitor Lead
7	Red, Small, Capacitor Lead	Red, Small, Capacitor Lead

A-B - Oil Conditioner Leads

MOTOR CONNECTIONS		
Lead	DR-2 Mach.	DR-3 & 4 Mach.
Running	Red or Green	White
Common	Black	Red or Green
Starting	White	Black

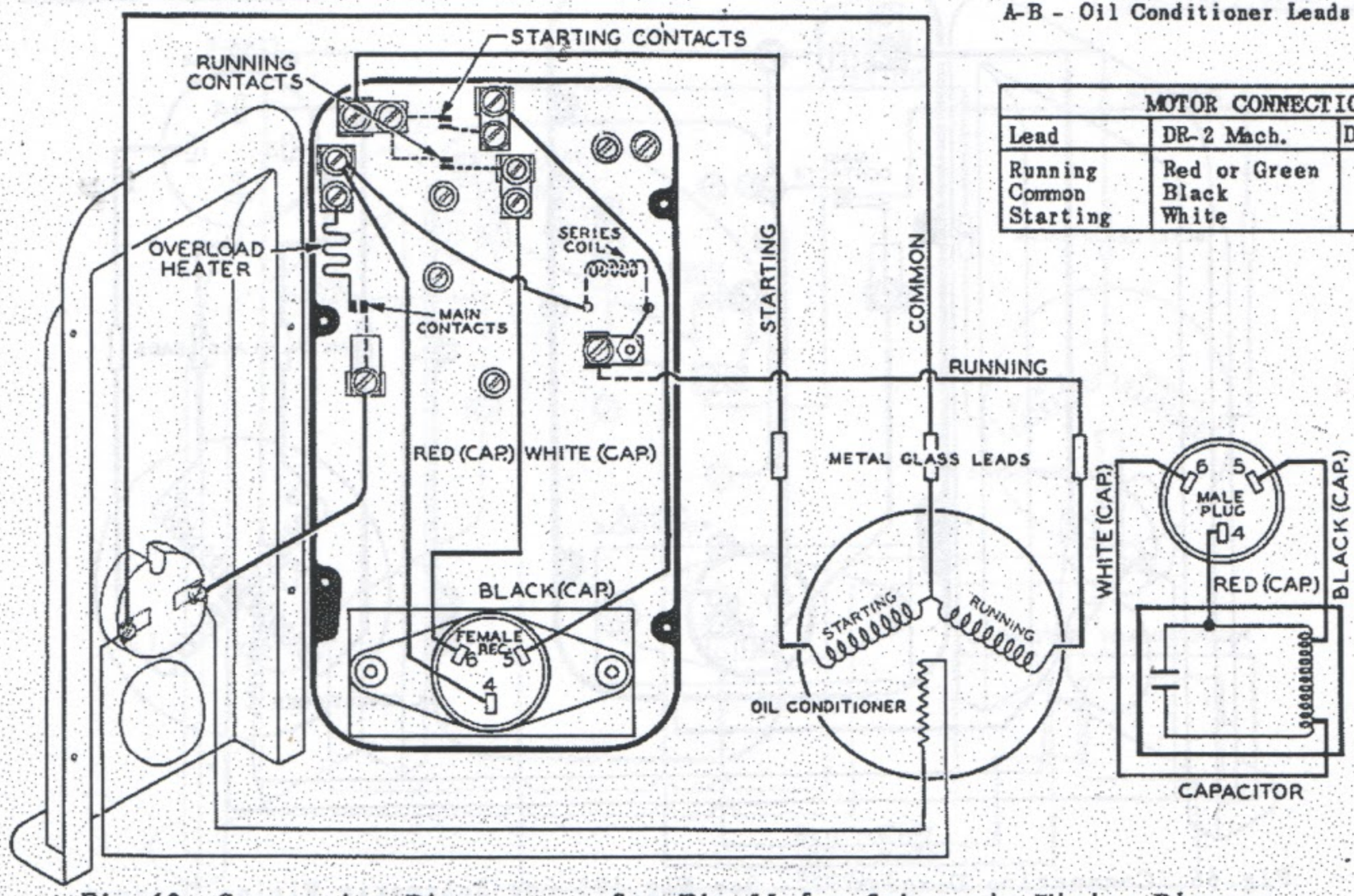


Fig. 69 Connection Diagram See Fig. 55 for Schematic Wiring Diagram

CR-1050-C-1 CONTROL - 60 CYCLE, 110 VOLTS

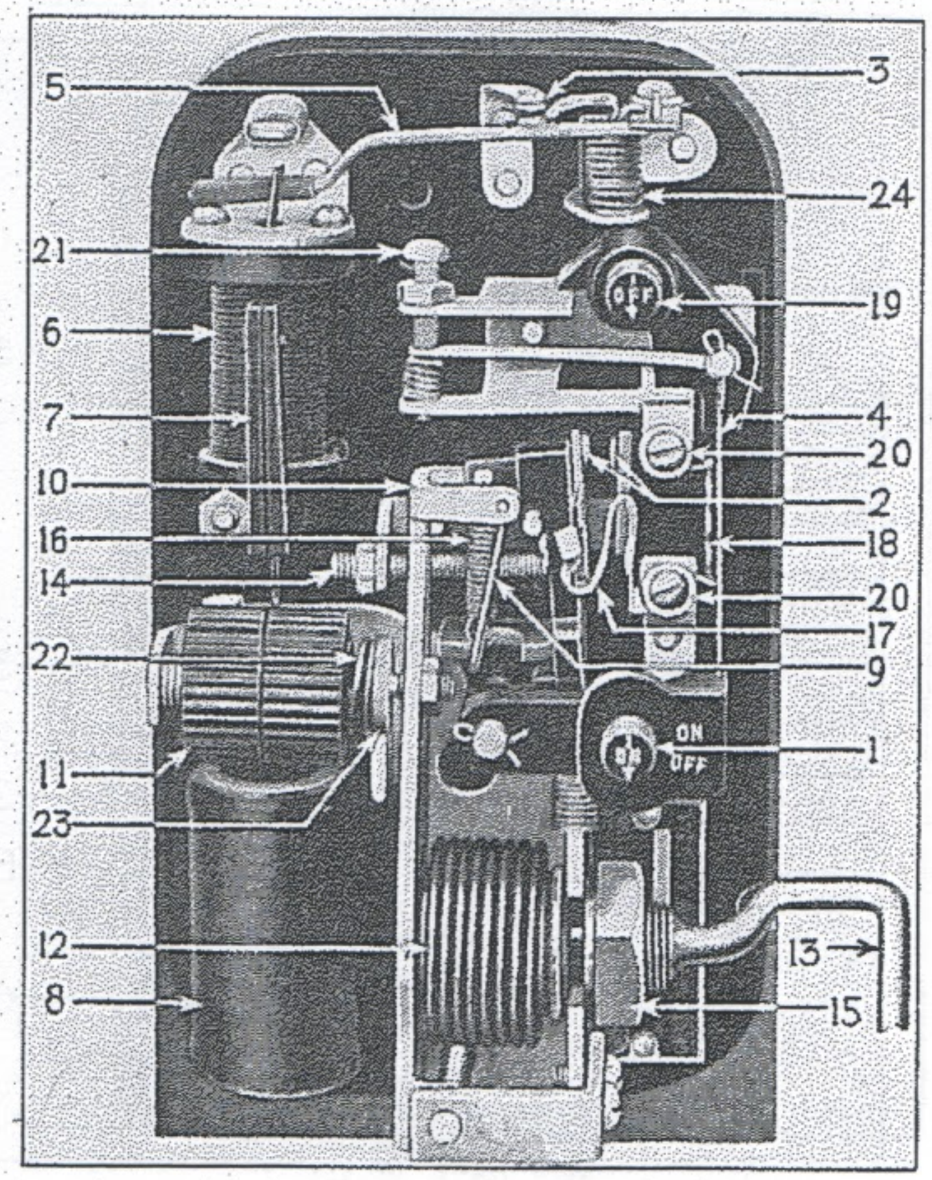


Fig. 70 Front View

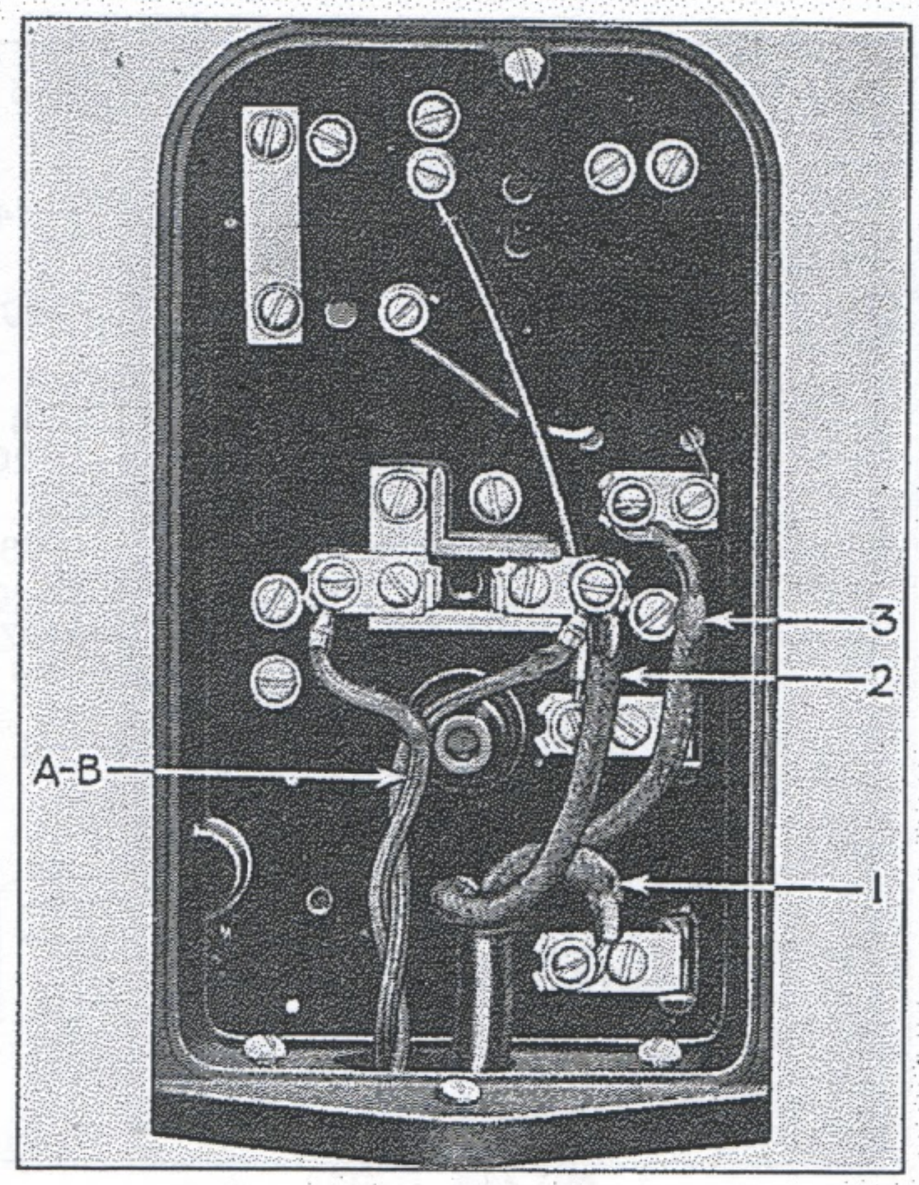


Fig. 71 Back View

1 Main Switch "On"
2 Main Contacts
3 Starting Contacts
4 Overload Cut-out
5 Starting Relay-Contact Arm
6 Starting Relay Coil
7 Starting Relay Armature
8 Starting Resistor
9 Bridle
10 Lever for Automatic Control
11 Temperature Adjustment Drum
12 Metallic Bellows
13 Bellows Tube to Evaporator
14 Temperature Range Adjustment Screw
15 Clamp Nut on Bellows
16 Bridle Spring
17 Flexible Lead
18 Overload Heater
19 Main Switch "Off"
20 Terminal Screws
21 Overload Adjusting Screw
22 Temperature Adjustment Spring
23 Temperature Adjustment Nut
24 Starting Arm Spring

MOTOR CONNECTIONS	
Lead	DR-2 Machines
Running	Red or Green
Common	Black
Starting	White

See Fig. 51 for Schematic Wiring Diagram

1 Short White Lead - Starting Winding
2 Medium Length Black Lead - Common Connection
3 Long Red Lead - Running Winding
A-B - Leads to Oil Conditioner

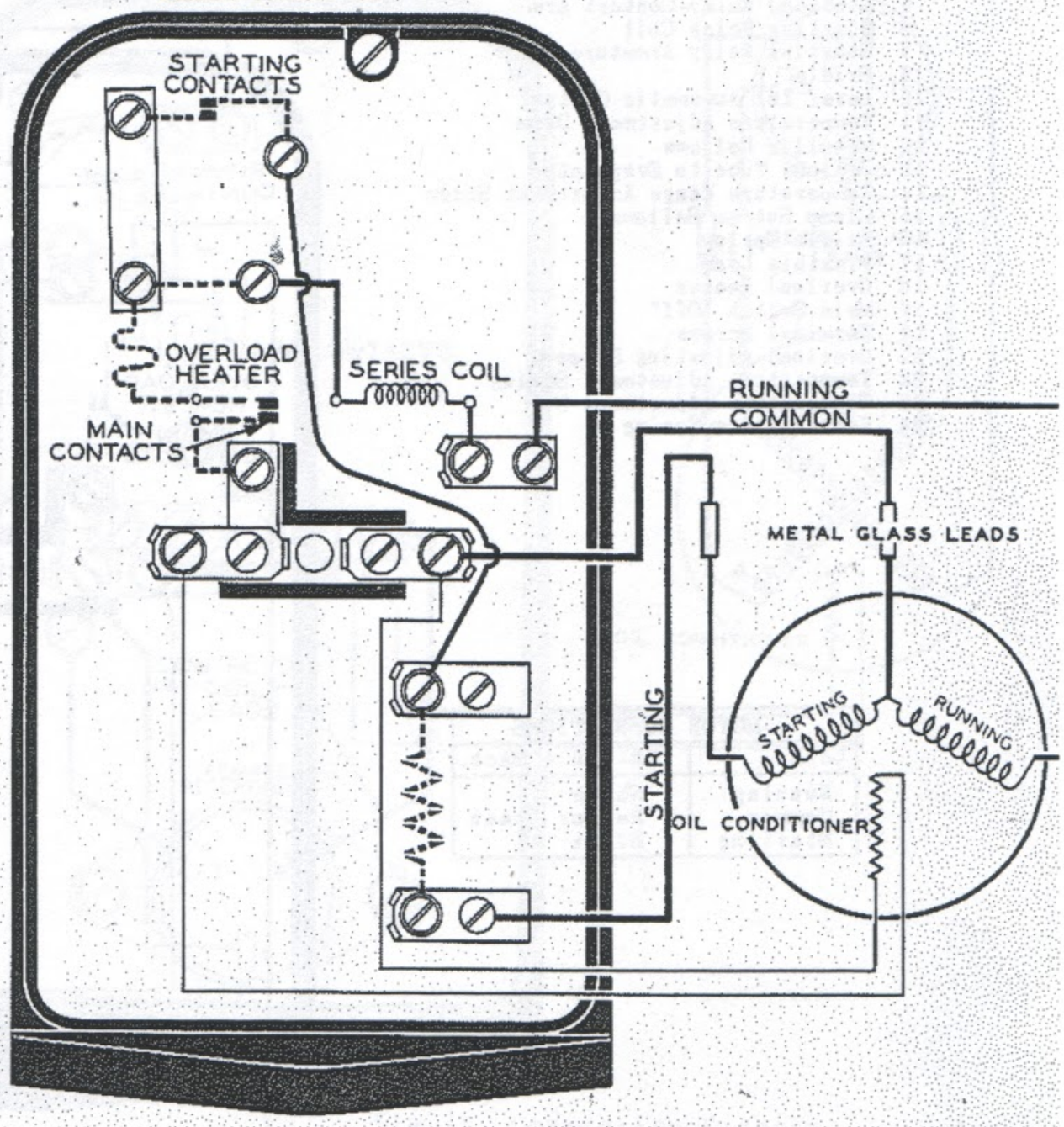


Fig. 72 Connection Diagram

CR-1050-C-2,6,10,15, & 18 CONTROL - 60 CYCLE, 110 VOLTS

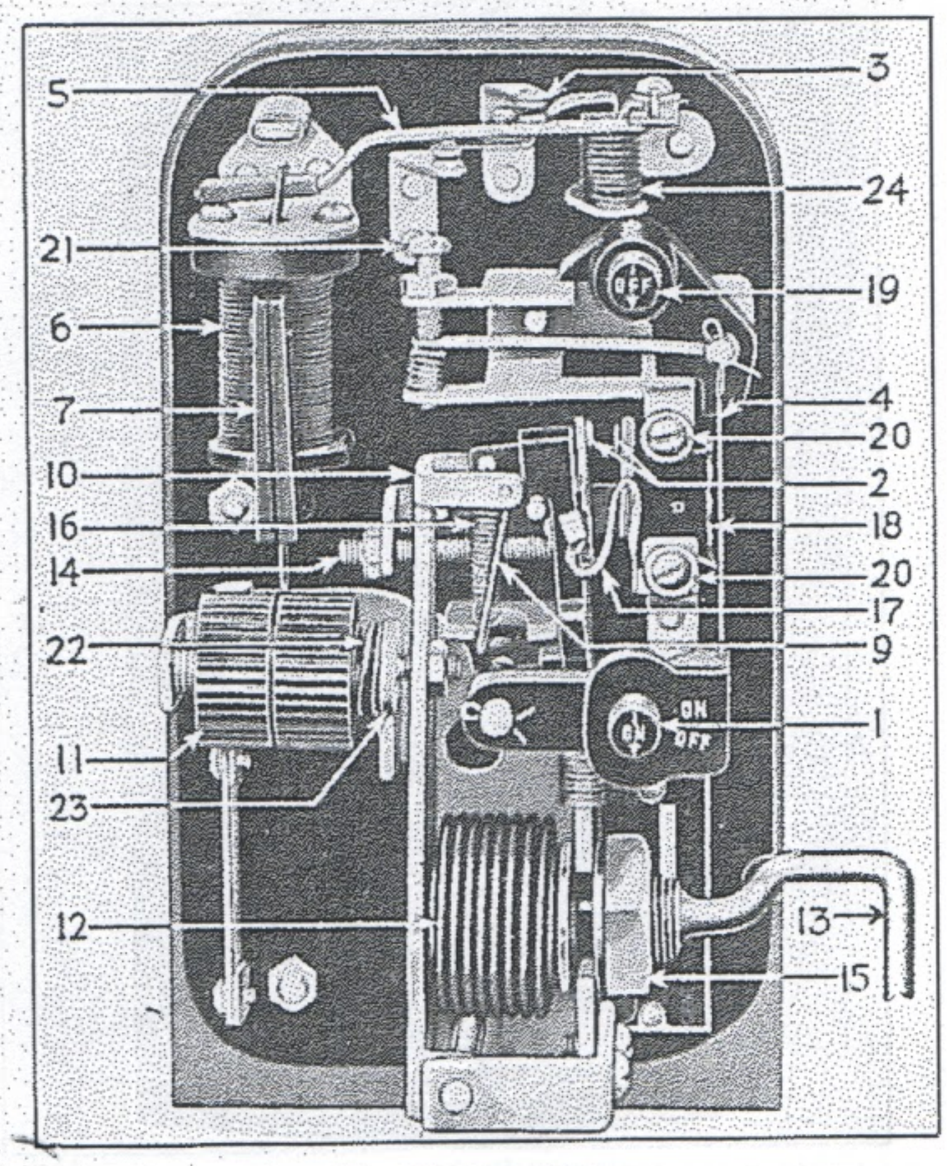


Fig. 73 Front View

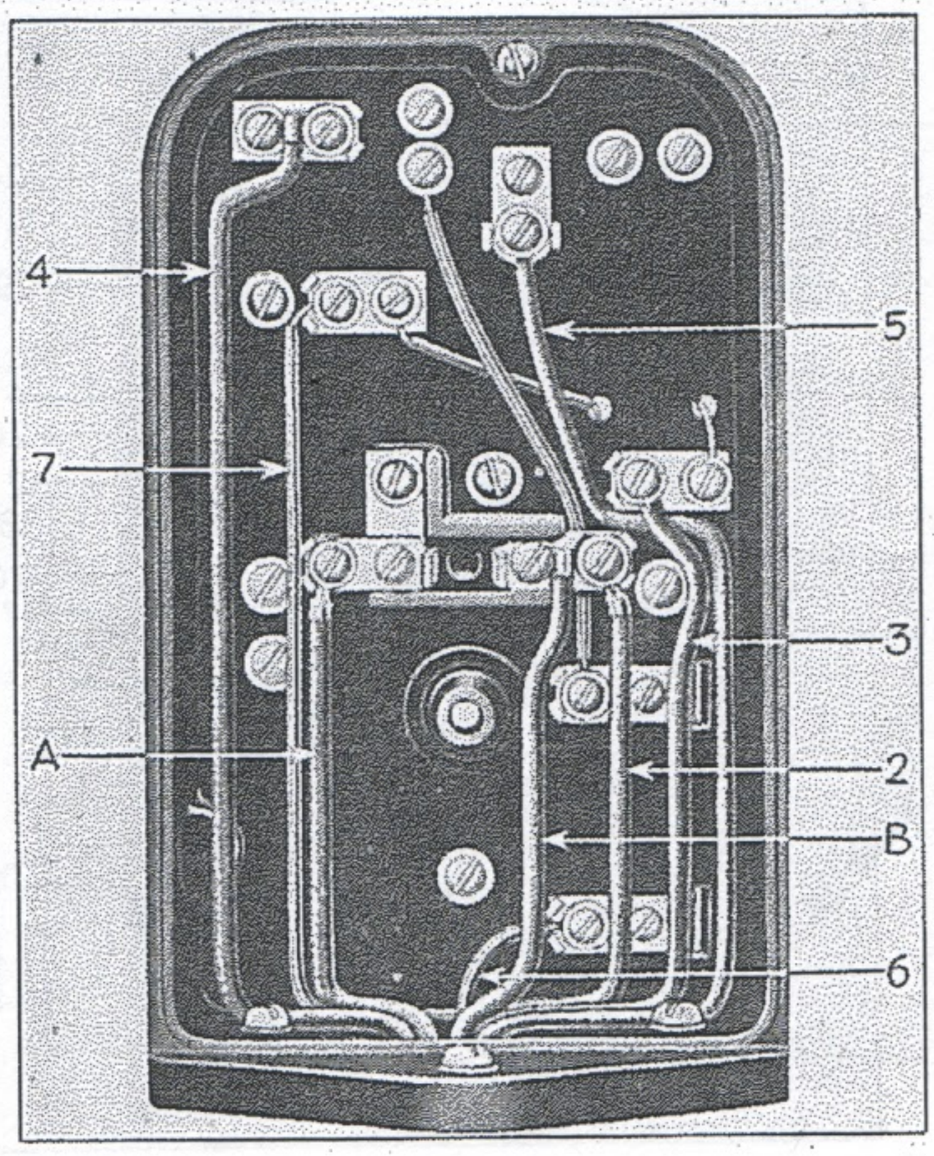


Fig. 74 Back View

1 Main Switch "On"
2 Main Contacts
3 Starting Contacts
4 Overload Cut-out
5 Starting Relay-Contact Arm
6 Starting Relay Coil
7 Starting Relay Armature
9 Bridle
10 Lever for Automatic Control
11 Temperature Adjustment Drum
12 Metallic Bellows
13 Bellows Tube to Evaporator
14 Temperature Range Adjustment Screw
15 Clamp Nut on Bellows
16 Bridle Spring
17 Flexible Lead
18 Overload Heater
19 Main Switch "Off"
20 Terminal Screws
21 Overload Adjusting Screw
22 Temperature Adjustment Spring
23 Temperature Adjustment Nut
24 Starting Arm Spring

2 Red, Large, Motor Lead, Common
3 White, Large, Motor Lead, Running
4 Black, Large, Motor Lead, Starting
5 White, Small, Capacitor Lead
6 Black, Small, Capacitor Lead
7 Red, Small, Capacitor Lead

A-B - Oil Conditioner Leads

MOTOR CONNECTIONS	
Lead	DR-3 & 4 Mach.
Running	White
Common	Red or Green
Starting	Black

See Fig. 55 for Schematic Wiring Diagram

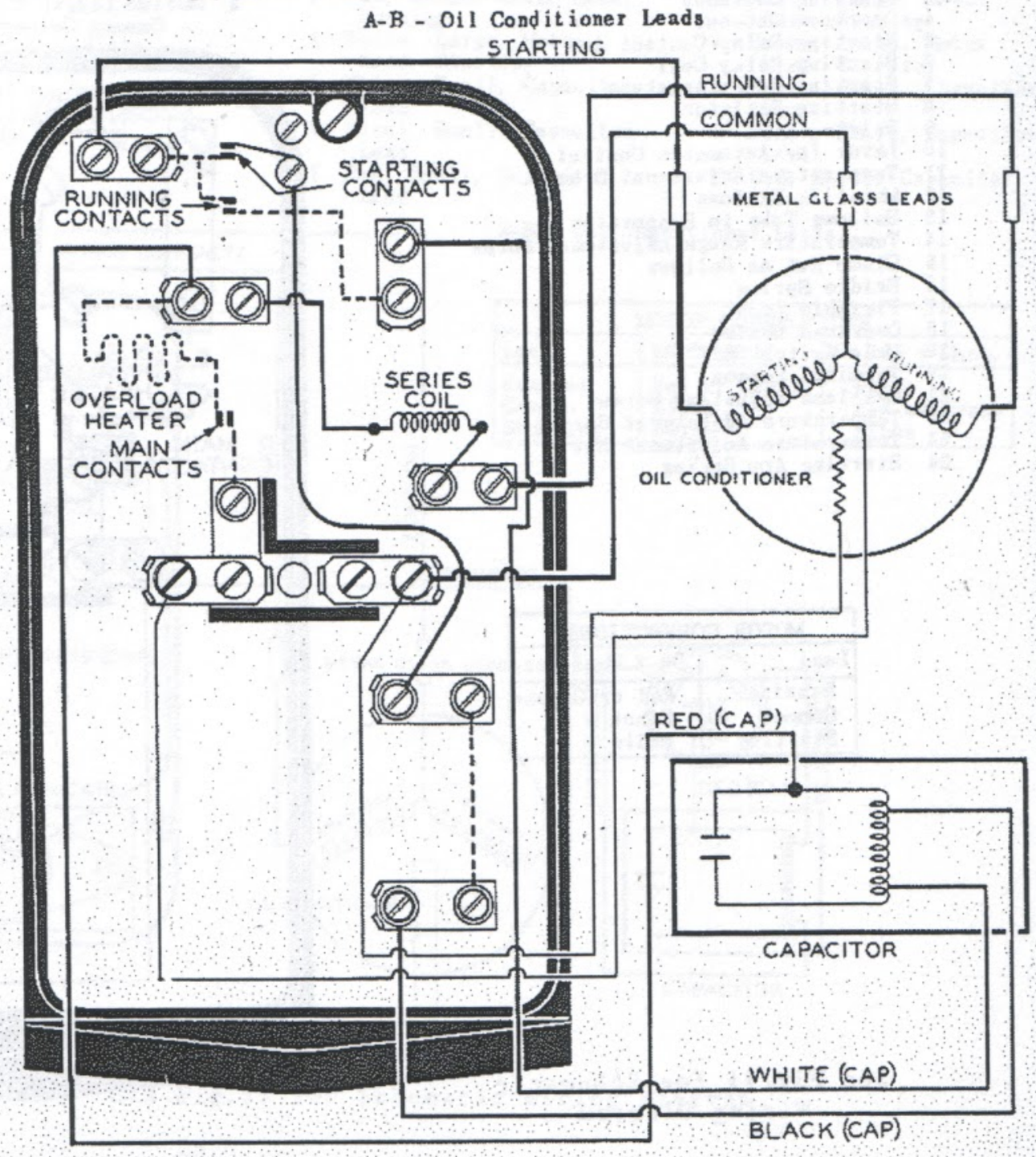


Fig. 75 Connection Diagram

CR-1050-C-3 CONTROL DIRECT CURRENT

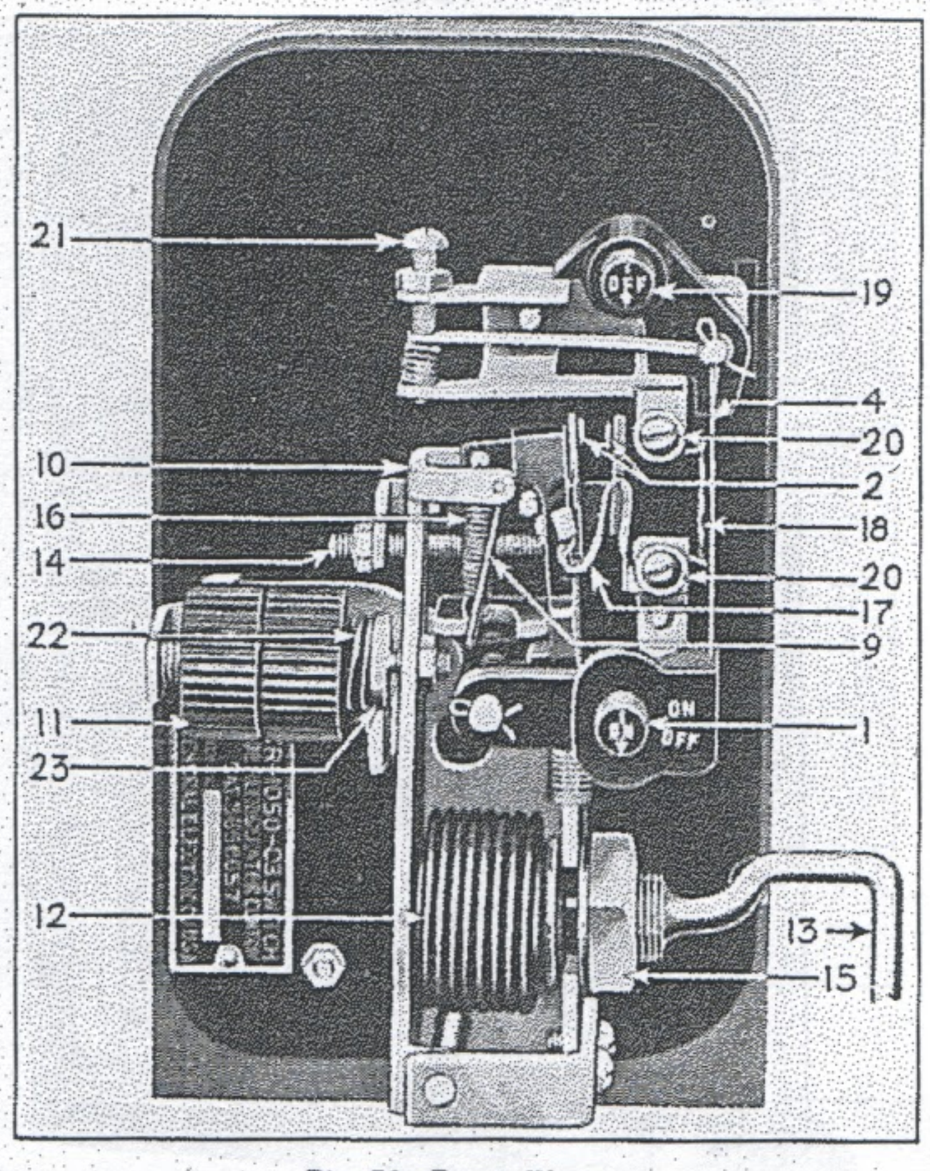


Fig. 76 Front View

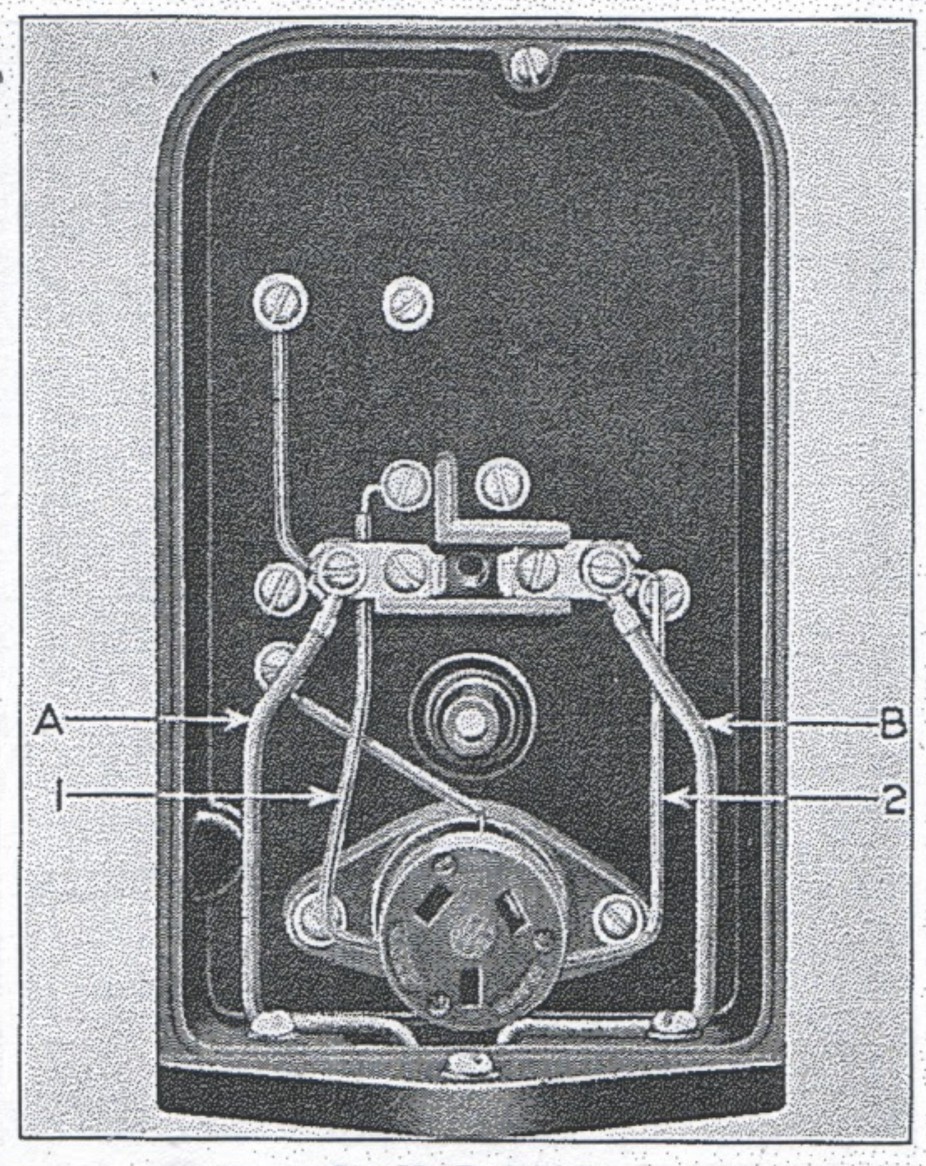
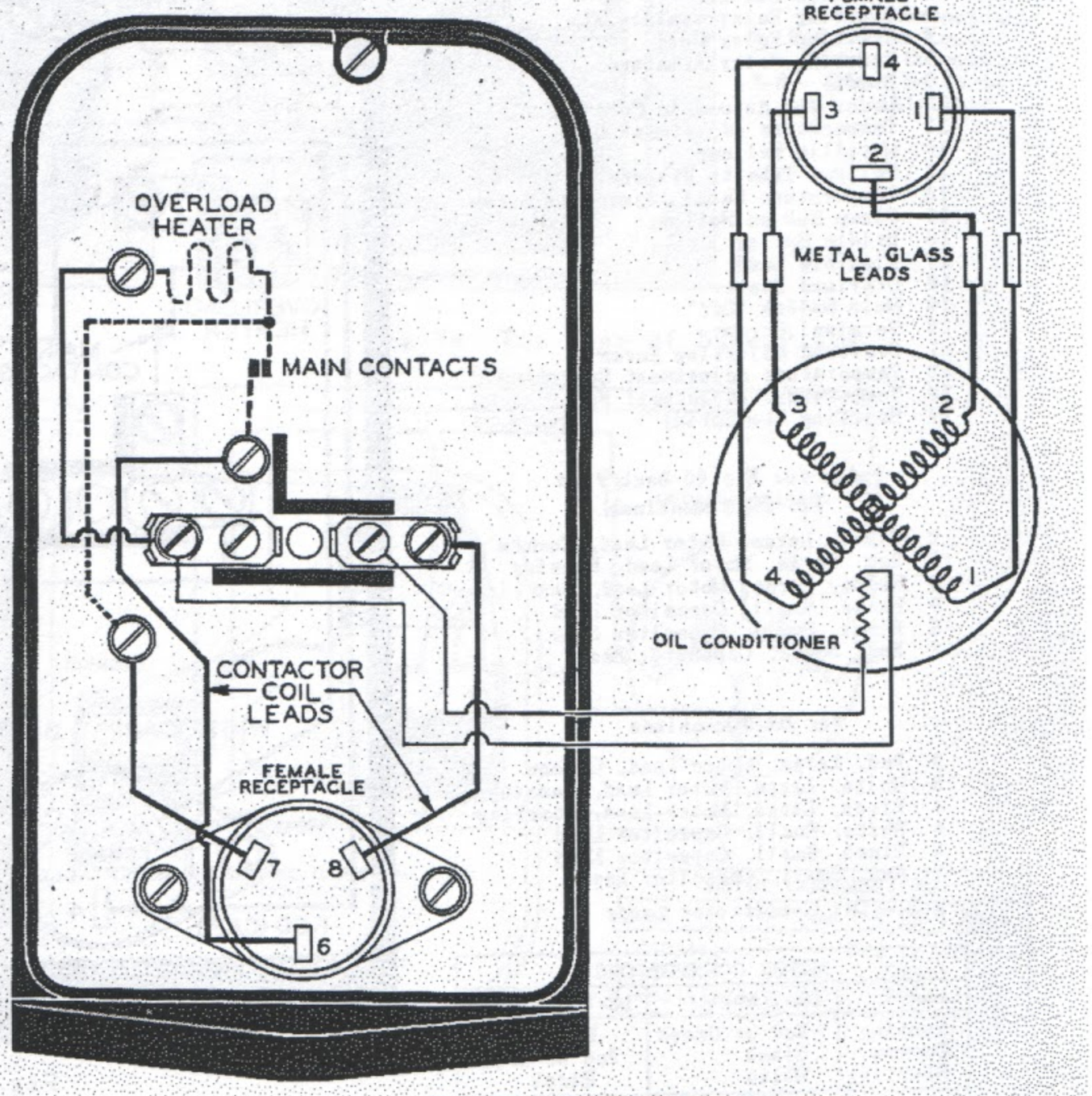


Fig. 77 Back View

1 Main Switch "On"
2 Main Contacts
4 Overload Cut-out
9 Bridle
10 Lever for Automatic Control
11 Temperature Adjustment Drum
12 Metallic Bellows
13 Bellows Tube to Evaporator
14 Temperature Range Adjustment Screw
15 Clamp Nut on Bellows
16 Bridle Spring
17 Flexible Lead
18 Overload Heater
19 Main Switch "Off"
20 Terminal Screws
21 Overload Adjusting Screw
22 Temperature Adjustment Spring
23 Temperature Adjustment Nut
24 Starting Arm Spring

1 Contactor Coil Leads
2 Contactor Coil Leads
A-B - Oil Conditioner Leads

MOTOR CONNECTIONS	
No.	DR-2 & 3 Machines
1	White
2	Brown or Green
3	Black
4	Red
	See D-c Section



See Fig. 108 for Schematic Wiring Diagram

Fig. 78 Connection Diagram

CR-1050-C-4 CONTROL - 25 CYCLE, 110 VOLTS

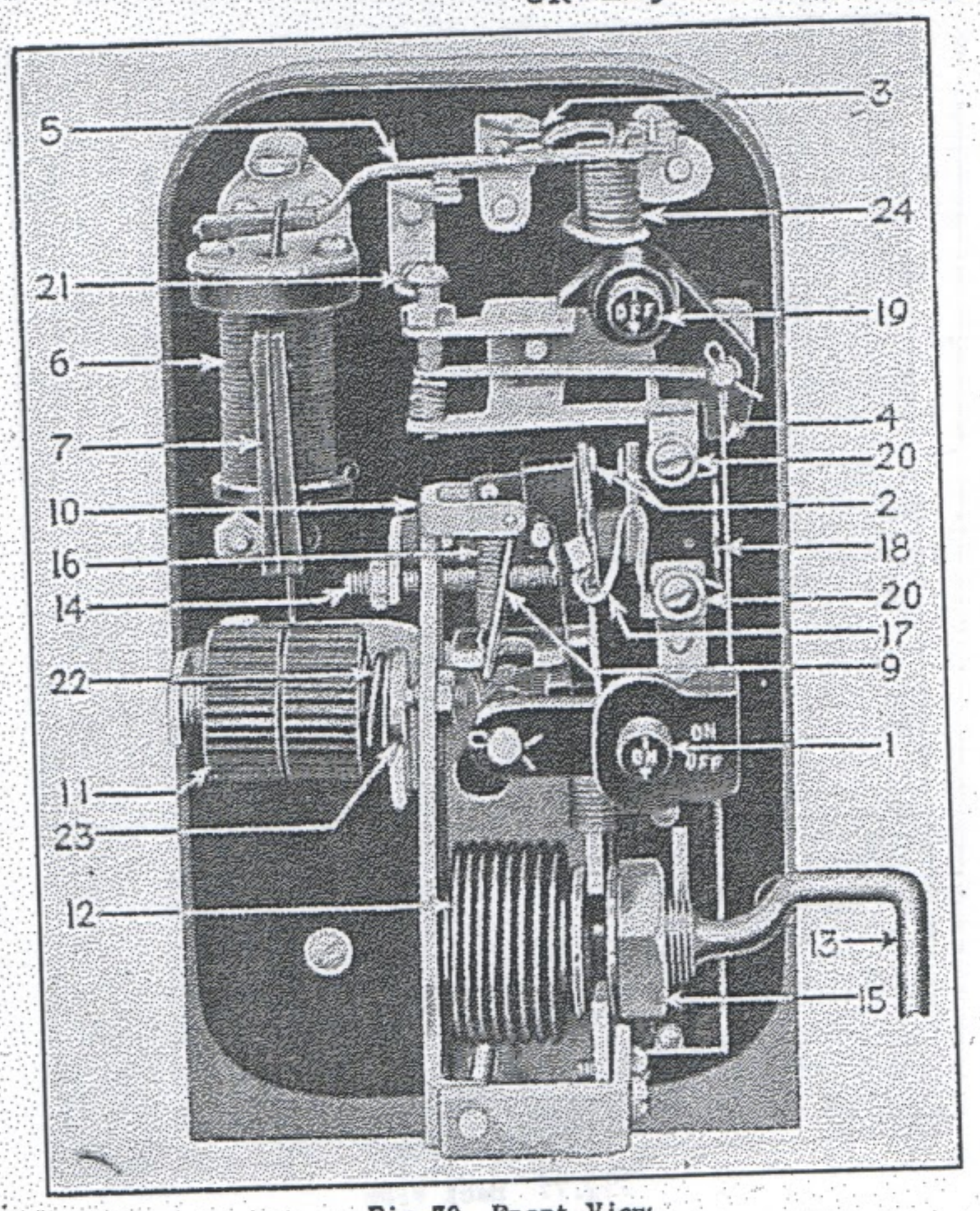


Fig. 79 Front View

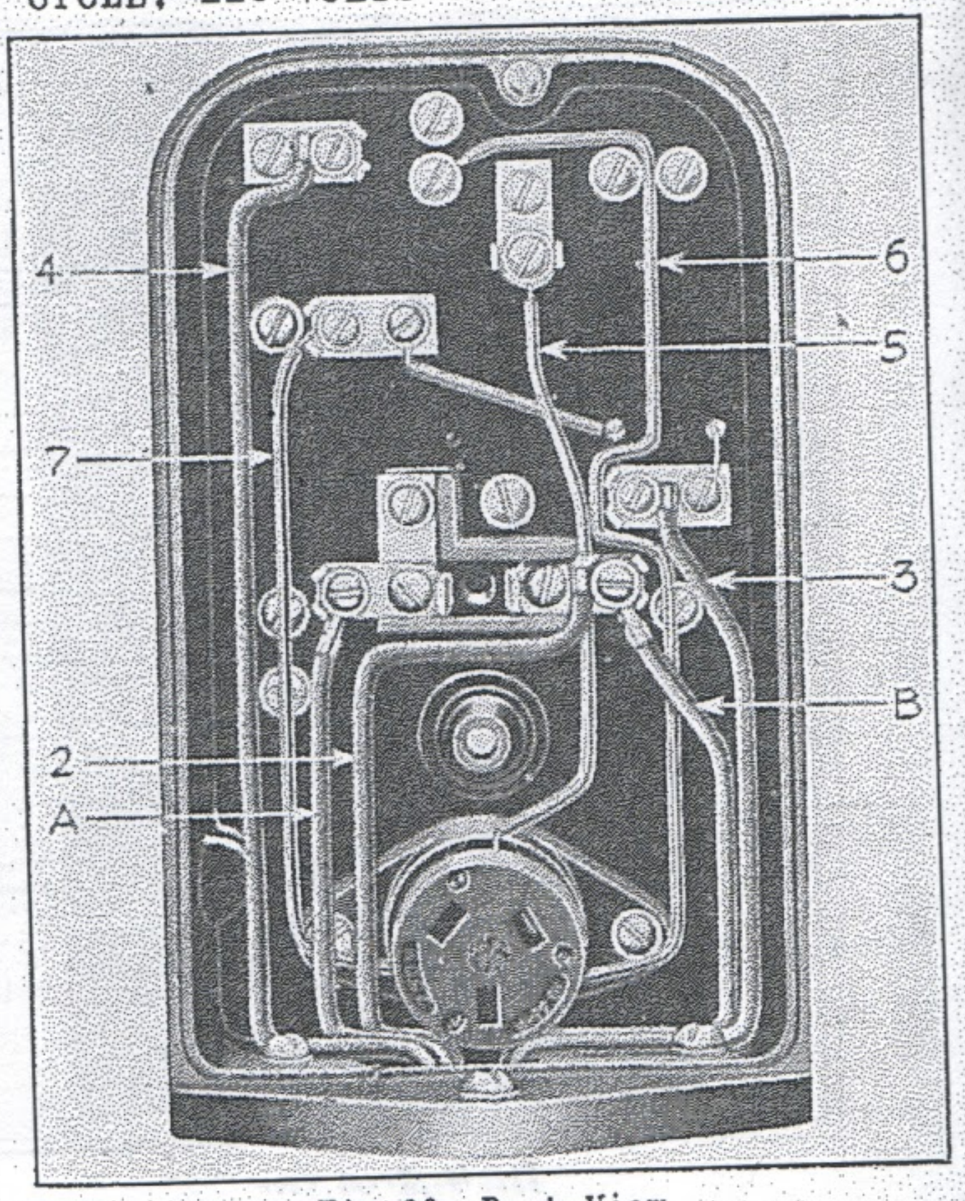


Fig. 80 Back View

1 Main Switch "On"
2 Main Contacts
3 Starting Contacts
4 Overload Cut-out
5 Starting Relay-Contact Arm
6 Starting Relay Coil
7 Starting Relay Armature
9 Bridle
10 Lever for Automatic Control
11 Temperature Adjustment Drum
12 Metallic Bellows
13 Bellows Tube to Evaporator
14 Temperature Range Adjustment Screw
15 Clamp Nut on Bellows
16 Bridle Spring
17 Flexible Lead
18 Overload Heater
19 Main Switch "Off"
20 Terminal Screws
21 Overload Adjusting Screw
22 Temperature Adjustment Spring
23 Temperature Adjustment Nut
24 Starting Arm Spring

Index for Fig. 80 Back View
For DR-2 Machines

2 Black, Large, Motor Lead, Common
3 Red, Large, Motor Lead, Running
4 White, Large, Motor Lead, Starting
5 White, Small, Capacitor Lead
6 Black, Small, Capacitor Lead
7 Red, Small, Capacitor Lead

For DR-3 Machines

2 Red, Large, Motor Lead, Common
3 White, Large, Motor Lead, Running
4 Black, Large, Motor Lead, Starting
5 White, Small, Capacitor Lead
6 Black, Small, Capacitor Lead
7 Red, Small, Capacitor Lead

A-B - Oil Conditioner Leads

MOTOR CONNECTIONS		
Lead	DR-2 Mach.	DR-3 & 4 Mach.
Running	Red or Green	White
Common	Black	Red or Green
Starting	White	Black

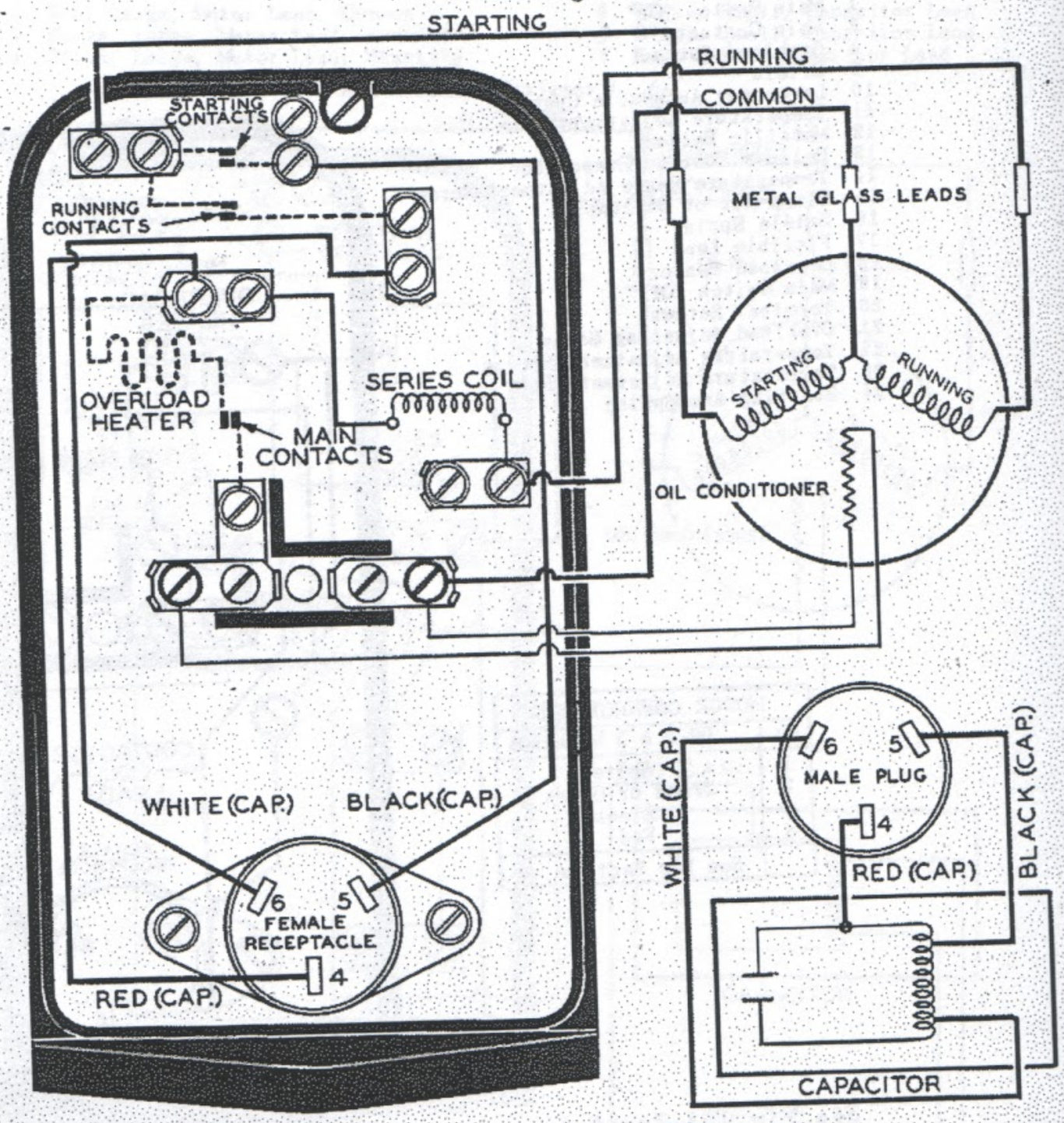


Fig. 81 Connection Diagram
See Fig. 55 for Schematic Wiring Diagram

CR-1050-D-1 CONTROL - 60 CYCLE, 110 VOLTS

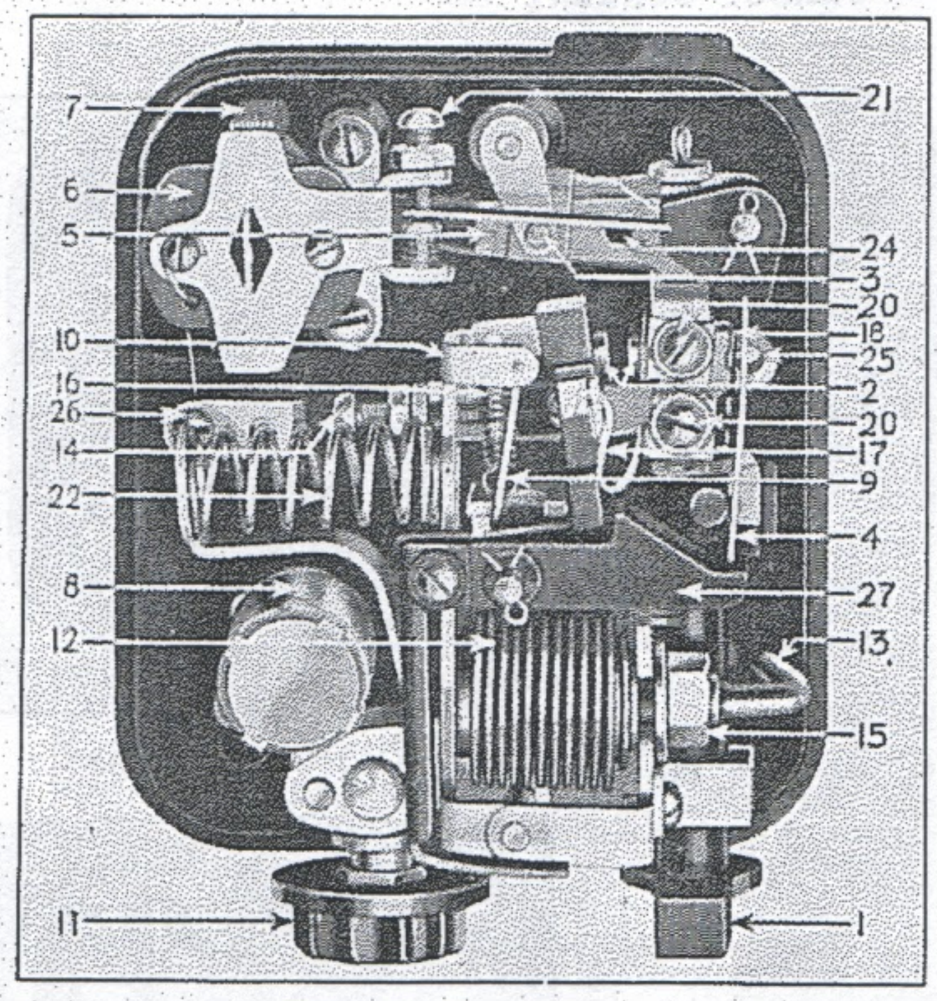
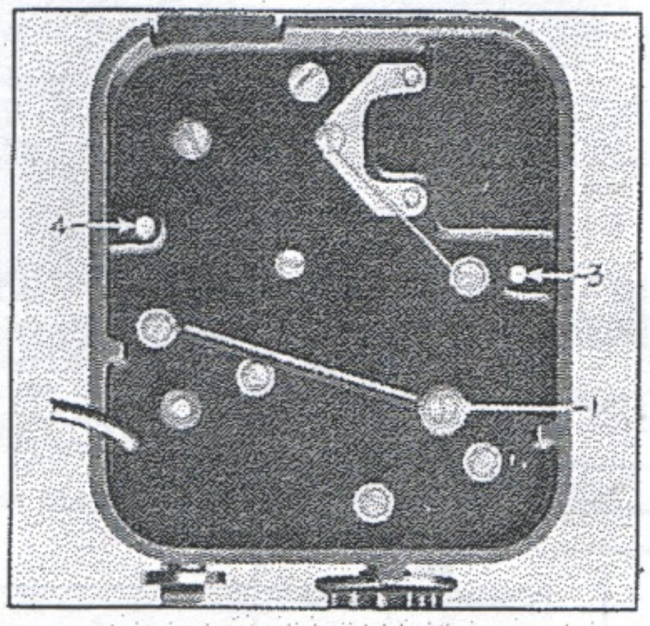


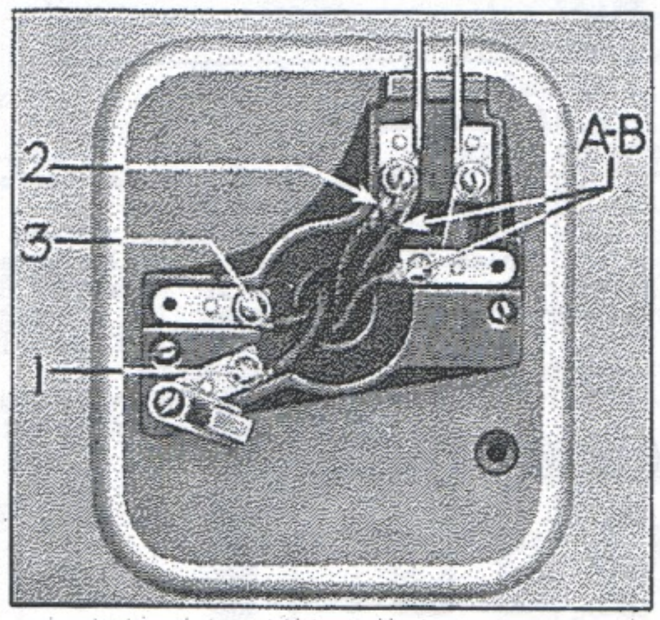
Fig. 82 Top View

1 Main Switch
2 Main Contacts
3 Starting Contacts
4 Overload Cut-out
5 Starting Relay Contact Arm
6 Starting Relay Coil
7 Starting Relay Armature
8 Starting Resistor
9 Bridle
10 Lever for Automatic Control
11 Temperature Adjusting Knob
12 Metallic Bellows
13 Bellows Tube to Evaporator
14 Temperature Range Adjustment Screw
15 Clamp Nut on Bellows
16 Bridle Spring for Contact Arm
17 Flexible Lead
18 Overload Heater
20 Overload Heater Screws
21 Overload Adjusting Screw
22 Temperature Adjustment Spring
24 Starting Arm Spring
25 Contact Screw for Removing Control, also Common Motor Lead Connection
26 Contact Screw for Removing Control, also Running Motor Lead Connection
27 Latch and Indicating Arm



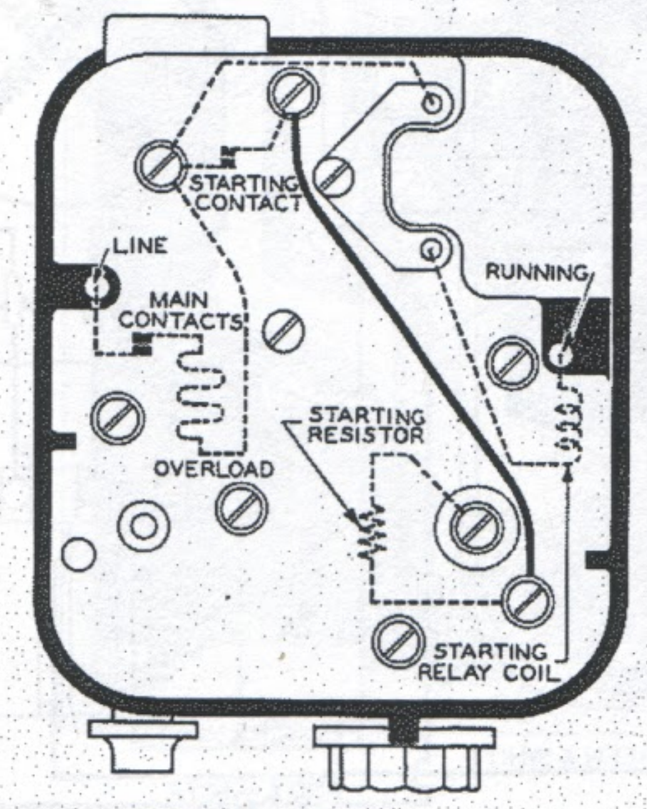
1 Starting Resistor Connection
3 Running Winding Connection
4 Line Connection

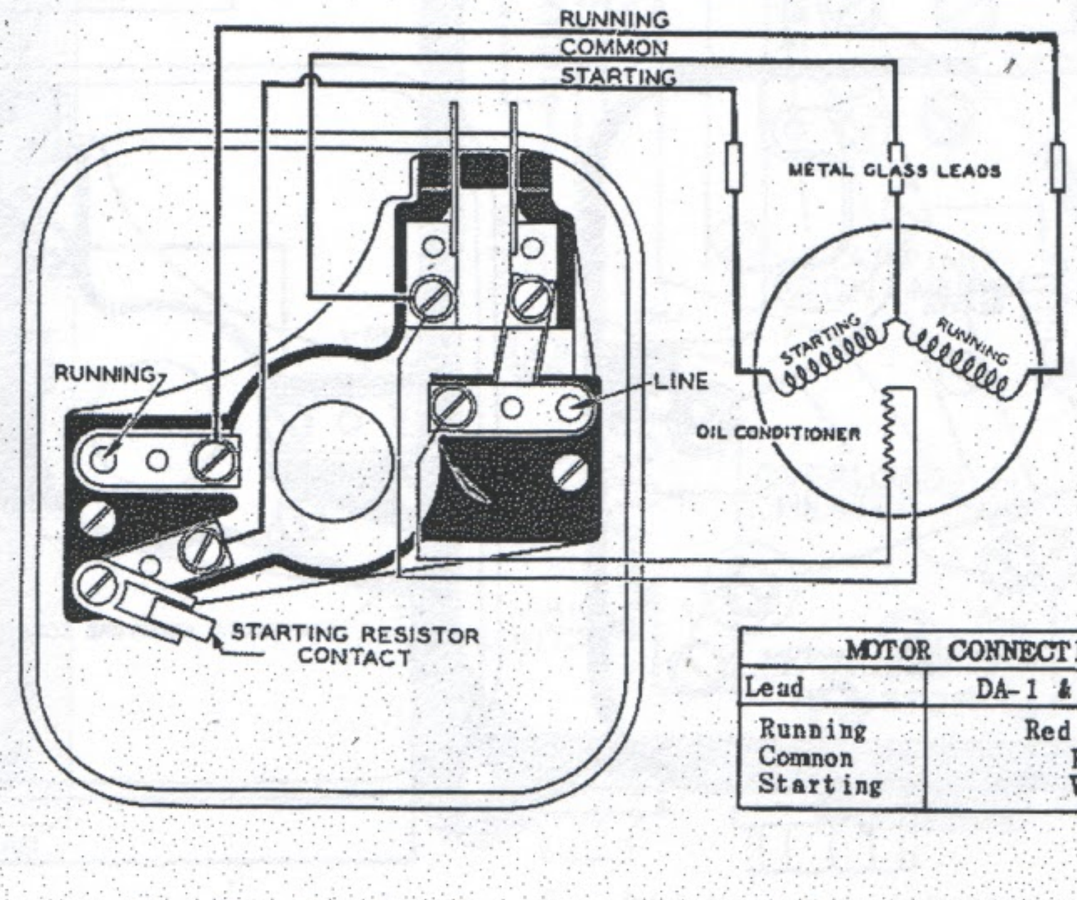
Fig. 83 Back View of Control



1 White, Motor Lead, Starting Winding Connection
2 Black, Motor Lead, Common Connection
3 Red, Motor Lead, Running Connection
A-B - Green Leads to Oil Conditioner

Fig. 84 Top View of Base Plate





MOTOR CONNECTIONS	
Lead	DA-1 & DR-1 Mach.
Running	Red or Green
Comnon	Black
Starting	White

Fig. 85 Connection Diagram

See Fig. 54 for Schematic Wiring Diagram

CR-1050-D-2 CONTROL DIRECT CURRENT

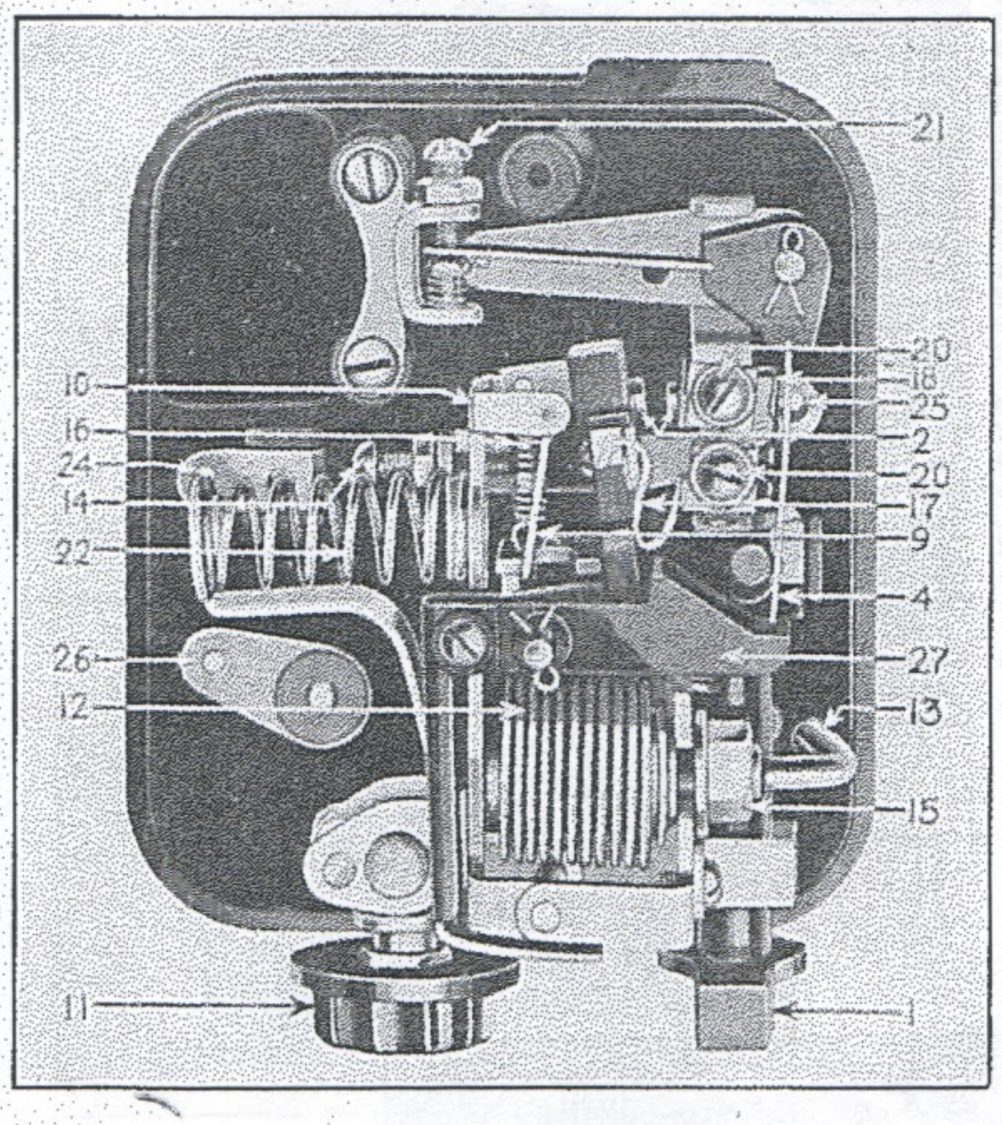


Fig. 86 Top View

1 Main Switch
2 Main Contacts
4 Overload Cut-Out
9 Bridle
10 Lever for Automatic Control
11 Temperature Adjusting Knob
12 Metallic Bellows
13 Bellows Tube to Evaporator
14 Temperature Range Adjusting Screw
15 Clamp Nut on Bellows
16 Bridle Spring for Contact Arm
18 Overload Heater
20 Overload Heater Screws
21 Overload Adjusting Screw
22 Temperature Adjusting Screw
24 Line Connection, Contact Screw
25 Contactor Coil Connection Contact Screw
26 Converter Armature Connection
27 Latch and Indicating Arm

1 Line Connection
3 Line Connection
4 Contactor Coil Connection

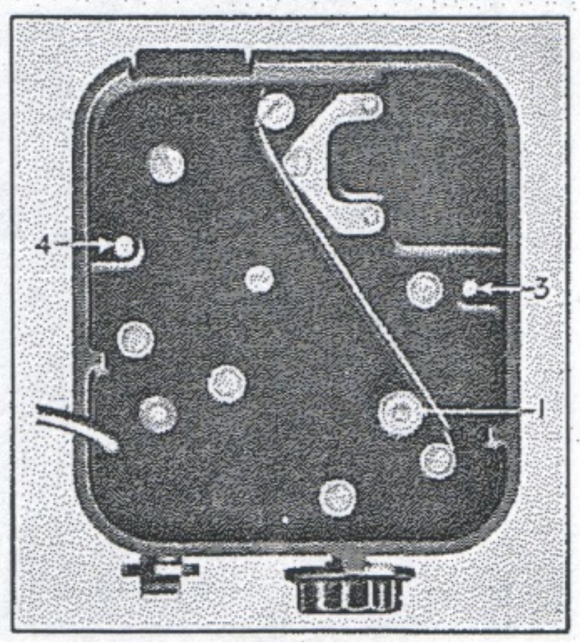


Fig. 87 Back View

6 Contactor Coil Connection
7 Line Connection
8 Line Connection
A-B - Oil Conditione. Leads

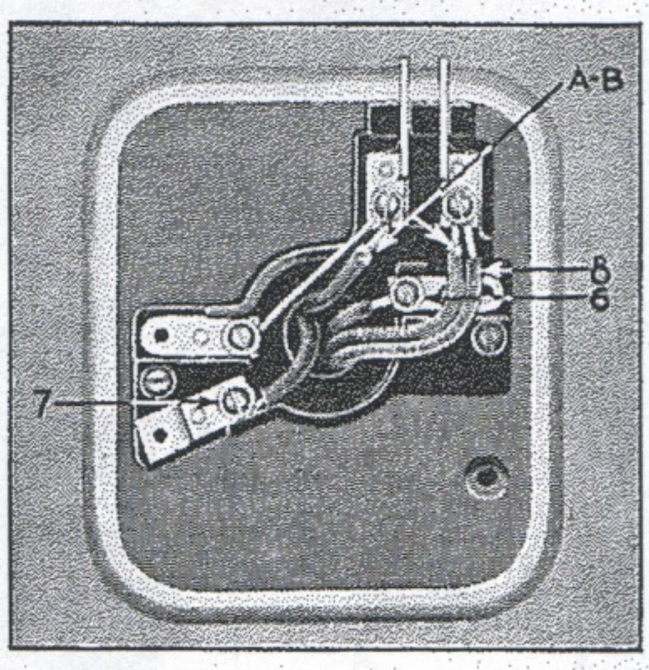


Fig. 88 Top View of Base Plate

MOTOR CONNECTIONS	
No.	DA-1 & DR-1 Mach.
1	White
2	Brown or Green
3	Black
4	Red
See D-c Section	

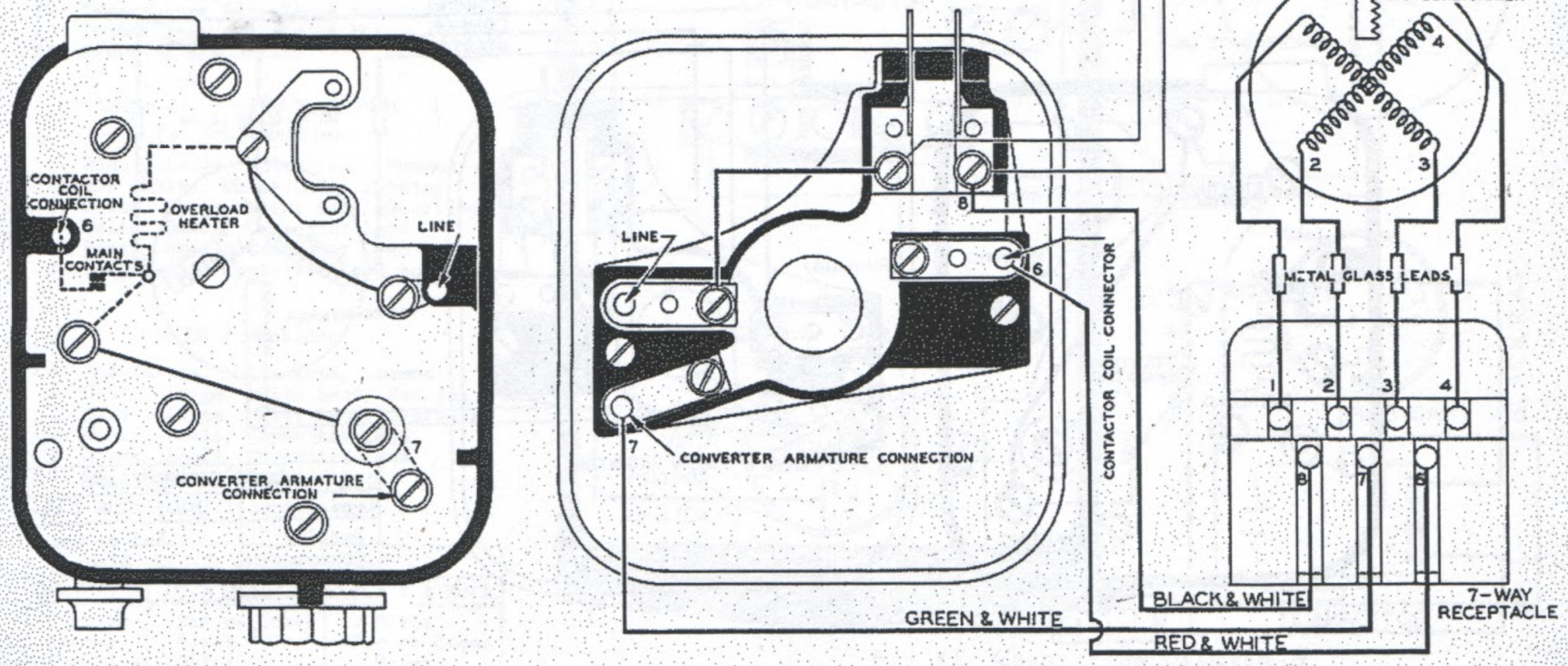


Fig. 89 Connection Diagram See Fig. 108 for Schematic Wiring Diagram

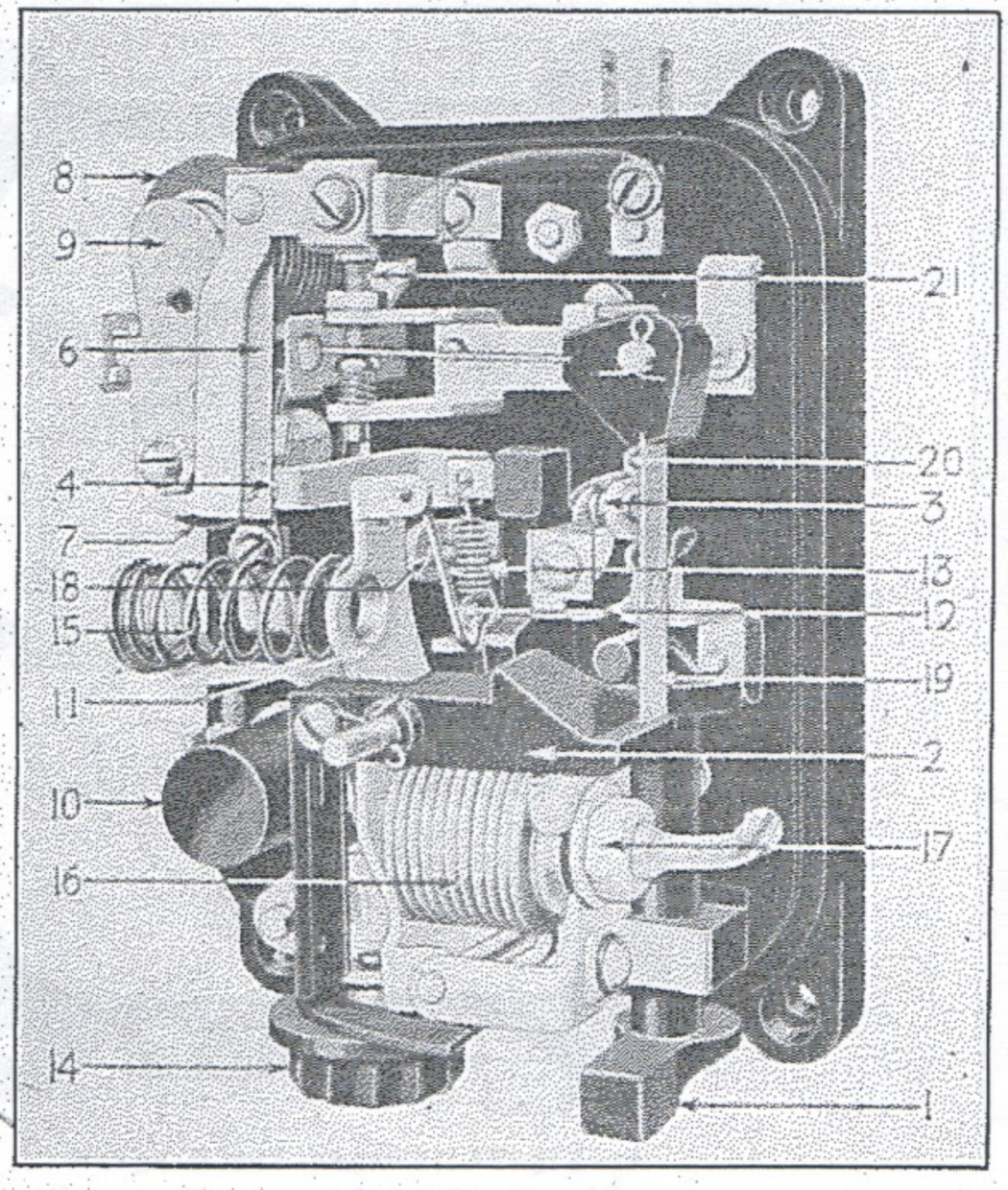


Fig.90 Top View

1 Main Switch
2 Latch and Indicating Arm
3 Main Contacts
4 Starting Contacts
6 Starting Contact Spring
7 Starting Relay Series Coil
8 Starting Relay Shunt Coil
9 Starting Relay Armature
10 Starting Resistor
11 Lever for Automatic Control
12 Bridle
13 Bridle Spring for Contact Arm
14 Temperature Adjusting Knob
15 Temperature Adjustment Spring
16 Metallic Bellows
17 Clamp Nut on Bellows
18 Temperature Range Adjusting Screw
19 Overload Cutout
20 Overload Heater
21 Overload Adjusting Screw

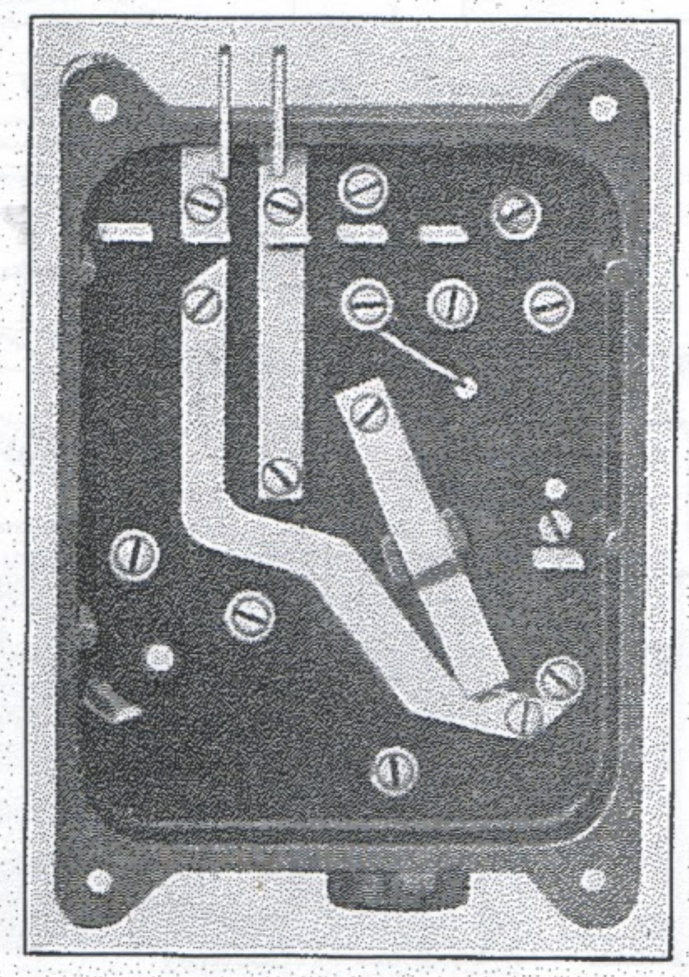


Fig.93 Back View

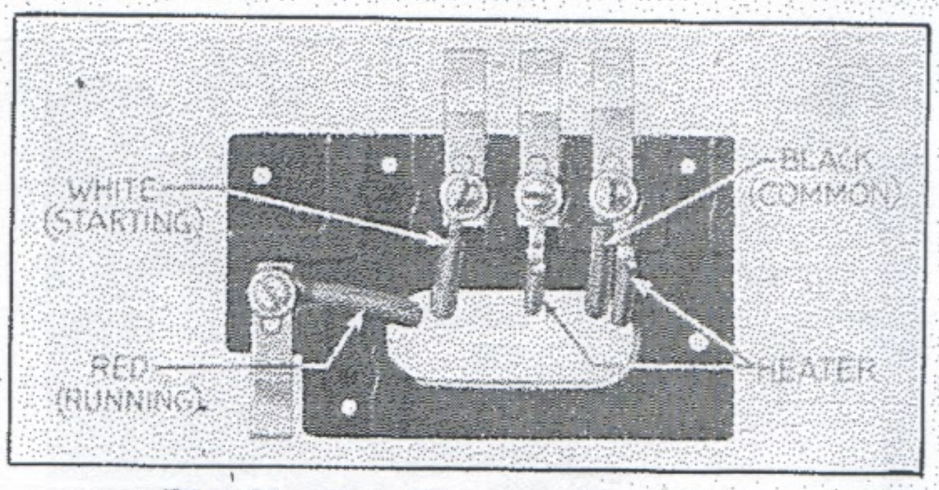


Fig.91 Top View of Base Plate

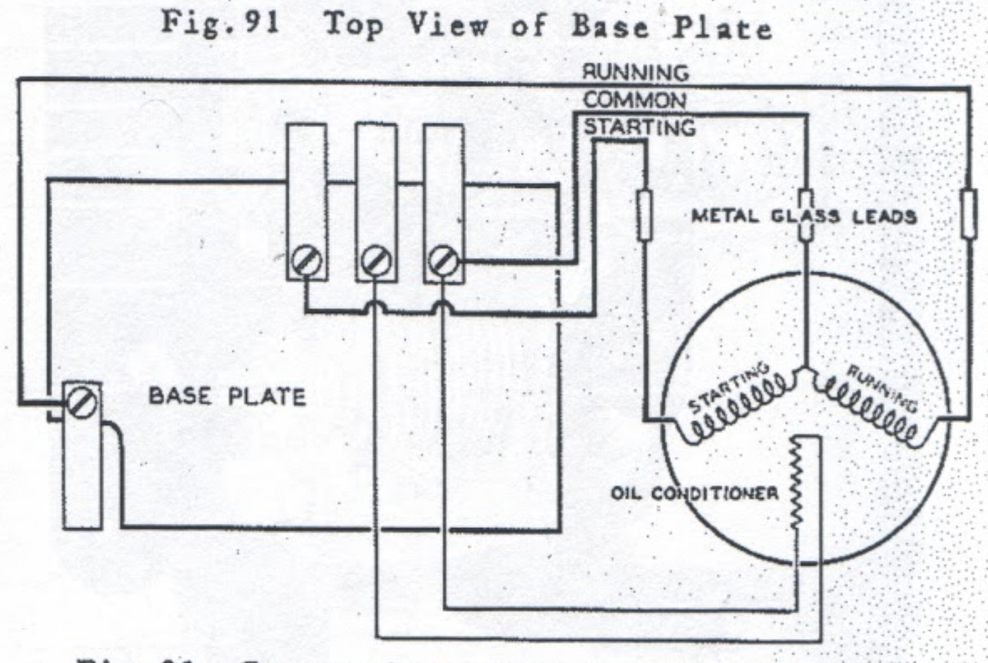


Fig.92 Connection Diagram of Base Plate

MOTOR CONNECTIONS	
Lead	DR-1 & 2 Mach.
Running	Red or Green
Common	Black
Starting	White

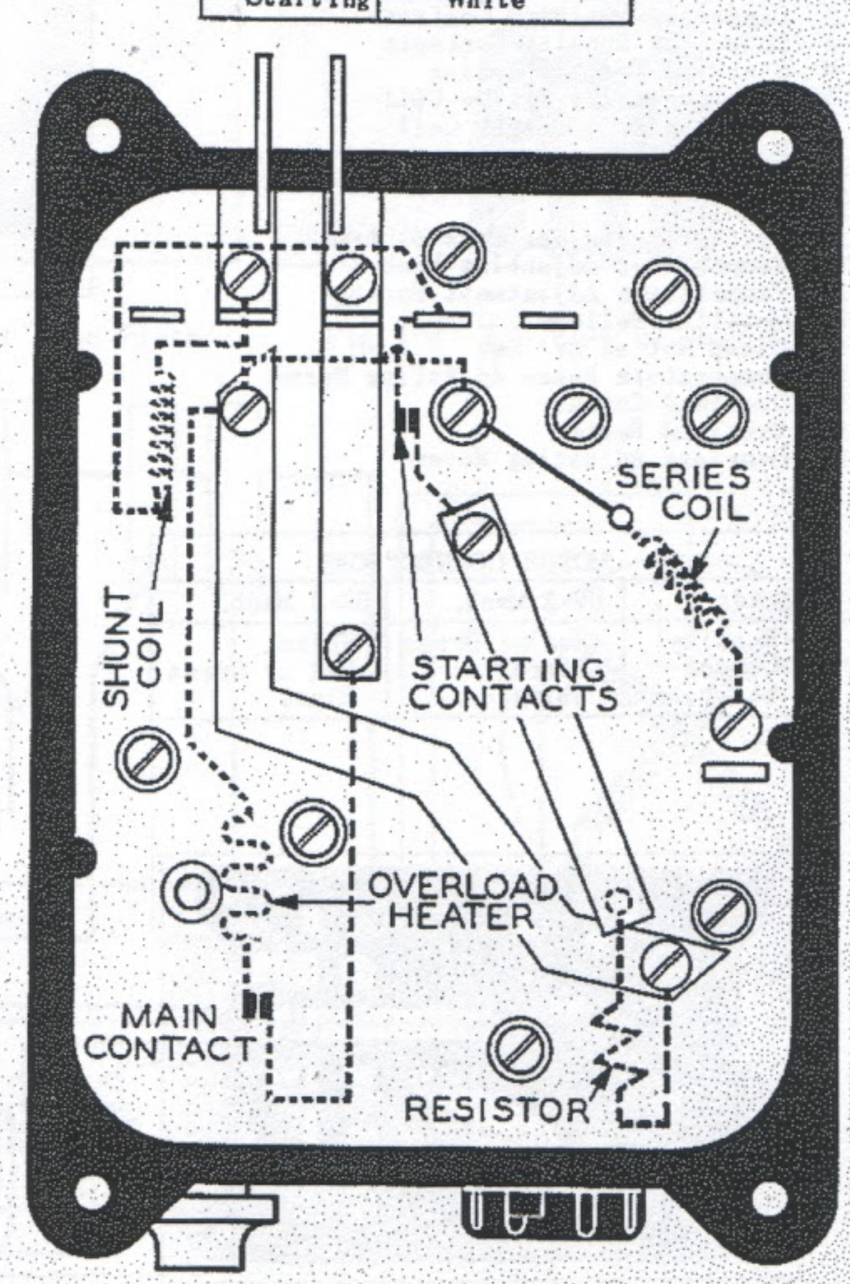


Fig.94 Connection Diagram
See Fig.54 for Schematic Wiring Diagram

CR-1050-E-2 CONTROL - 25 & 60 CYCLE, 110 VOLTS

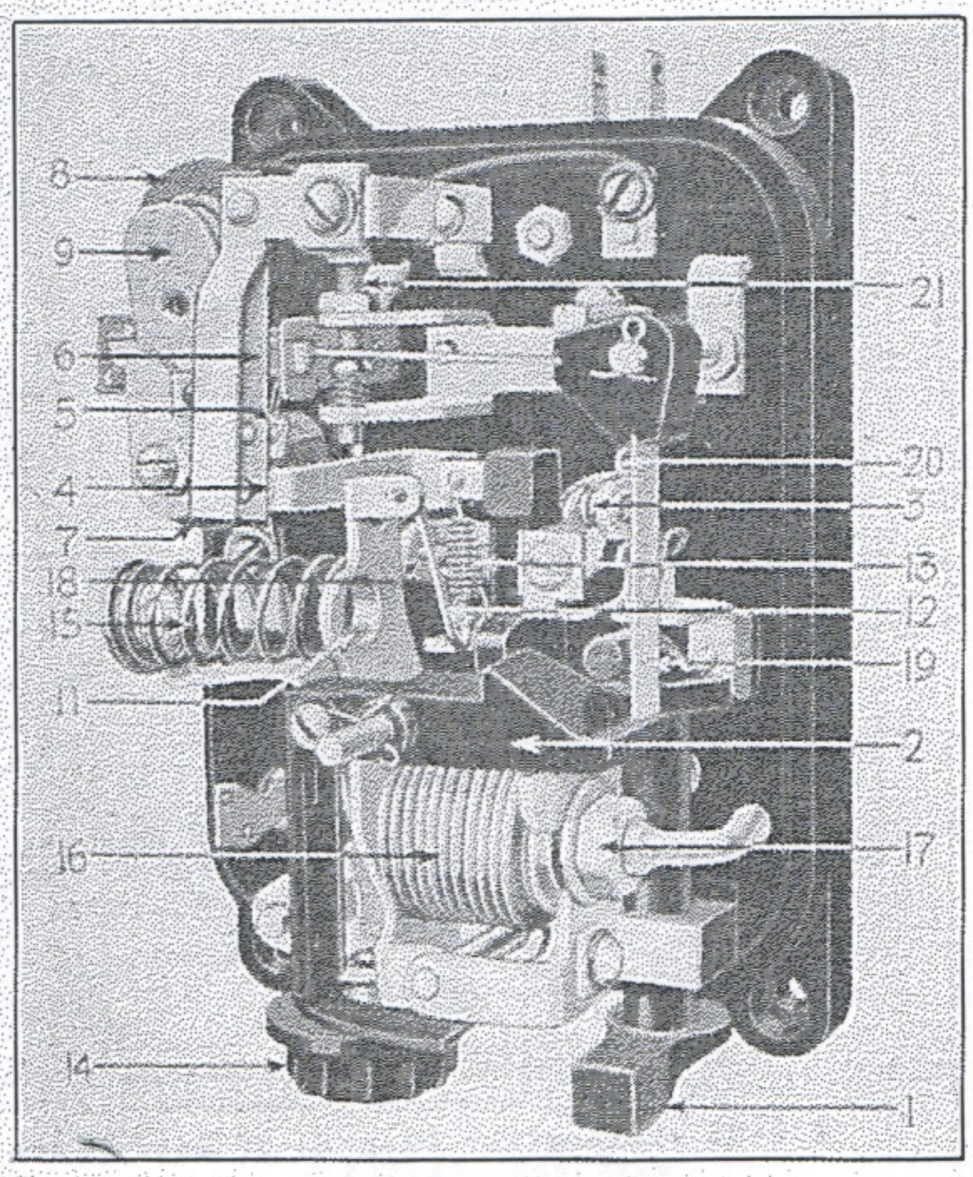


Fig.95 Top View

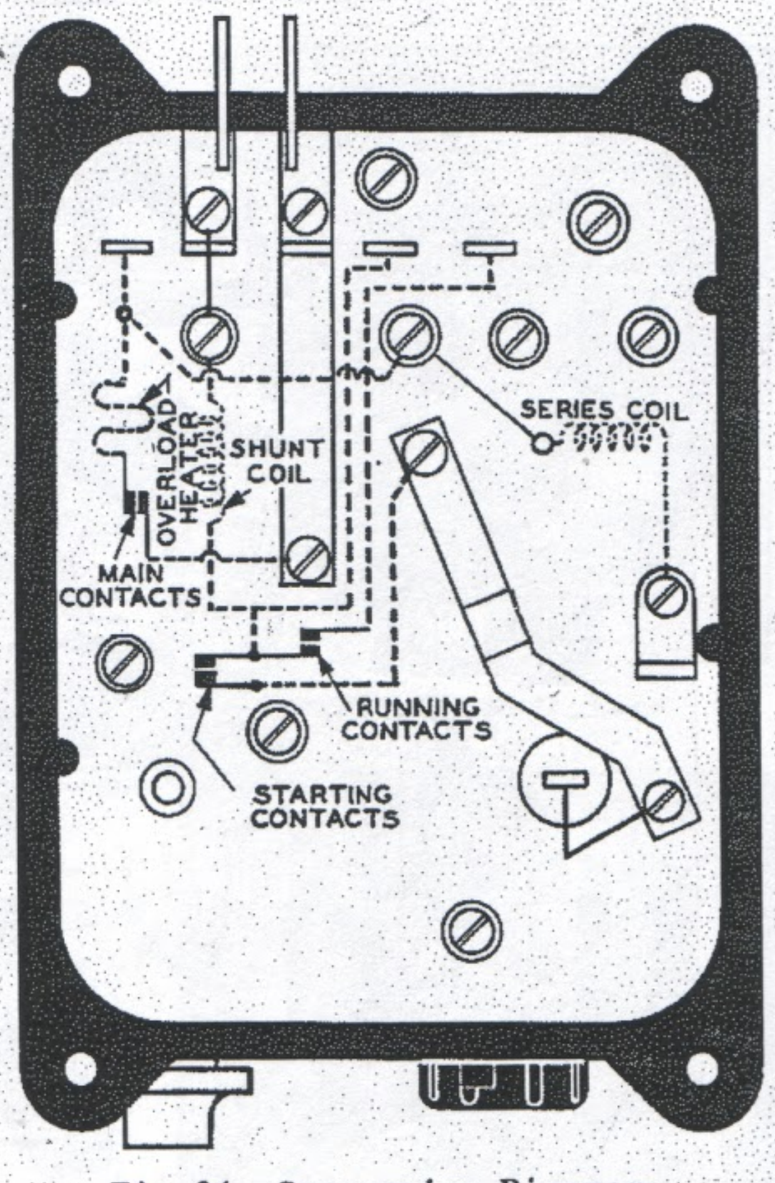


Fig.96 Connection Diagram
See Fig.56 for Schematic Wiring Diagram

1 Main Switch
2 Latch and Indicating Arm
3 Main Contacts
4 Capacitor Starting Contacts
5 Capacitor Running Contacts
6 Starting Contact Spring
7 Starting Relay Series Coil
8 Starting Relay Shunt Coil
9 Starting Relay Armature
11 Lever for Automatic Control
12 Bridle
13 Bridle Spring for Contact Arm
14 Temperature Adjusting Knob
15 Temperature Adjustment Spring
16 Metallic Bellows
17 Clamp Nut on Bellows
18 Temperature Range Adjusting Screw
19 Overload Cutout
20 Overload Heater
21 Overload Adjusting Screw

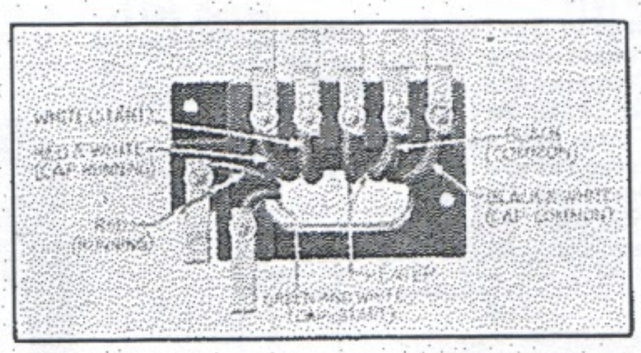


Fig.97 Top View of Base Plate

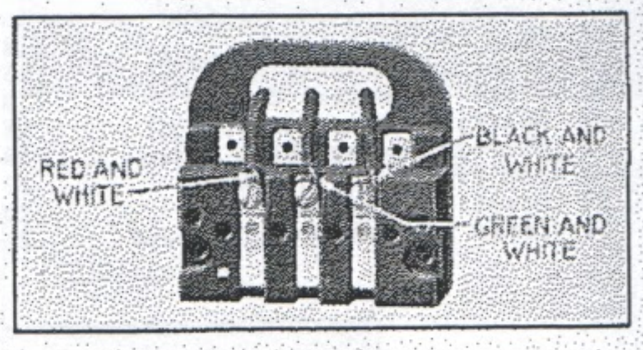
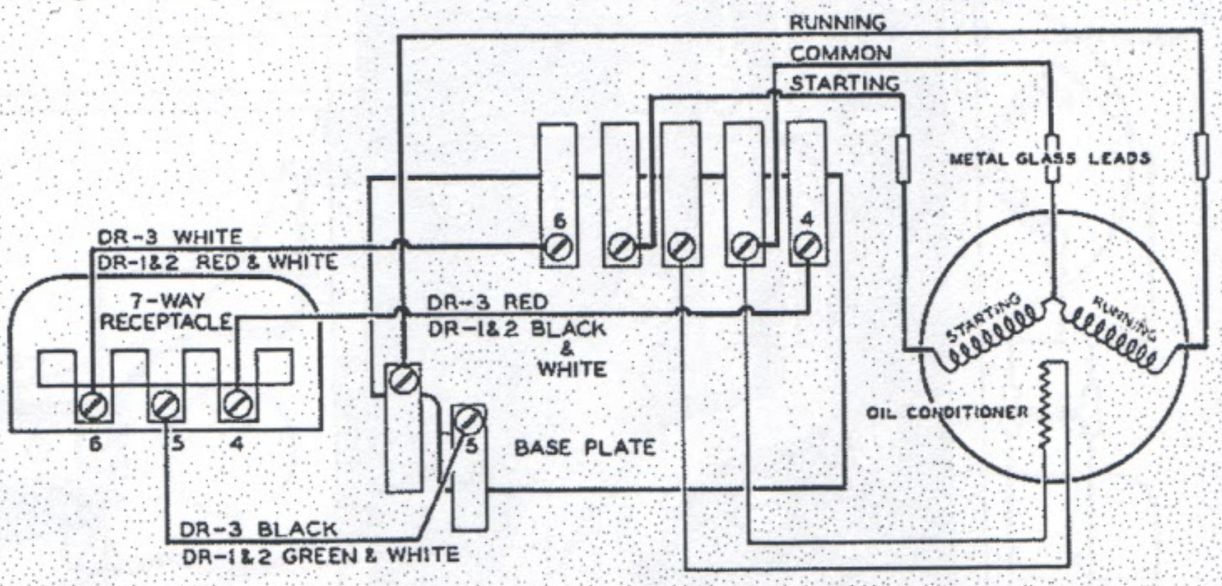


Fig.98 Top View of Receptacle

MOTOR CONNECTIONS		
Leads	DR-2 Mach.	DR-3 Mach.
Running	Red or Green	White
Common	Black	Red or Green
Starting	White	Black



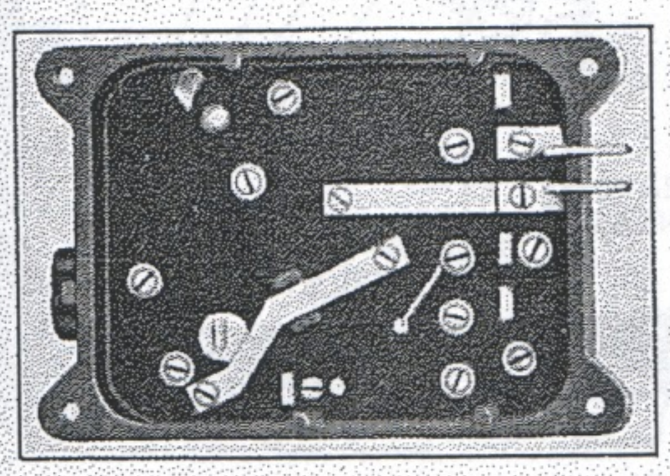


Fig.99 Back View

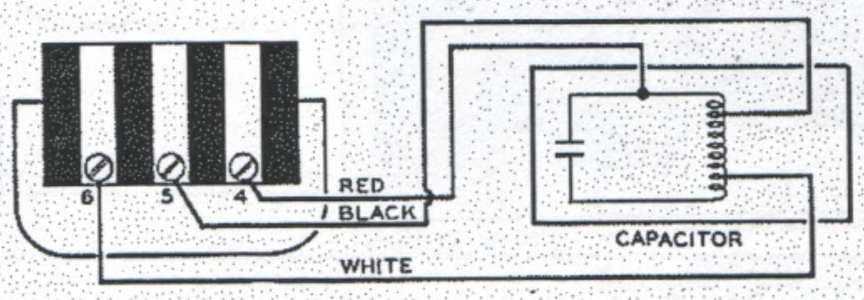


Fig.100 Connection Diagram - Base Plate and Receptacle

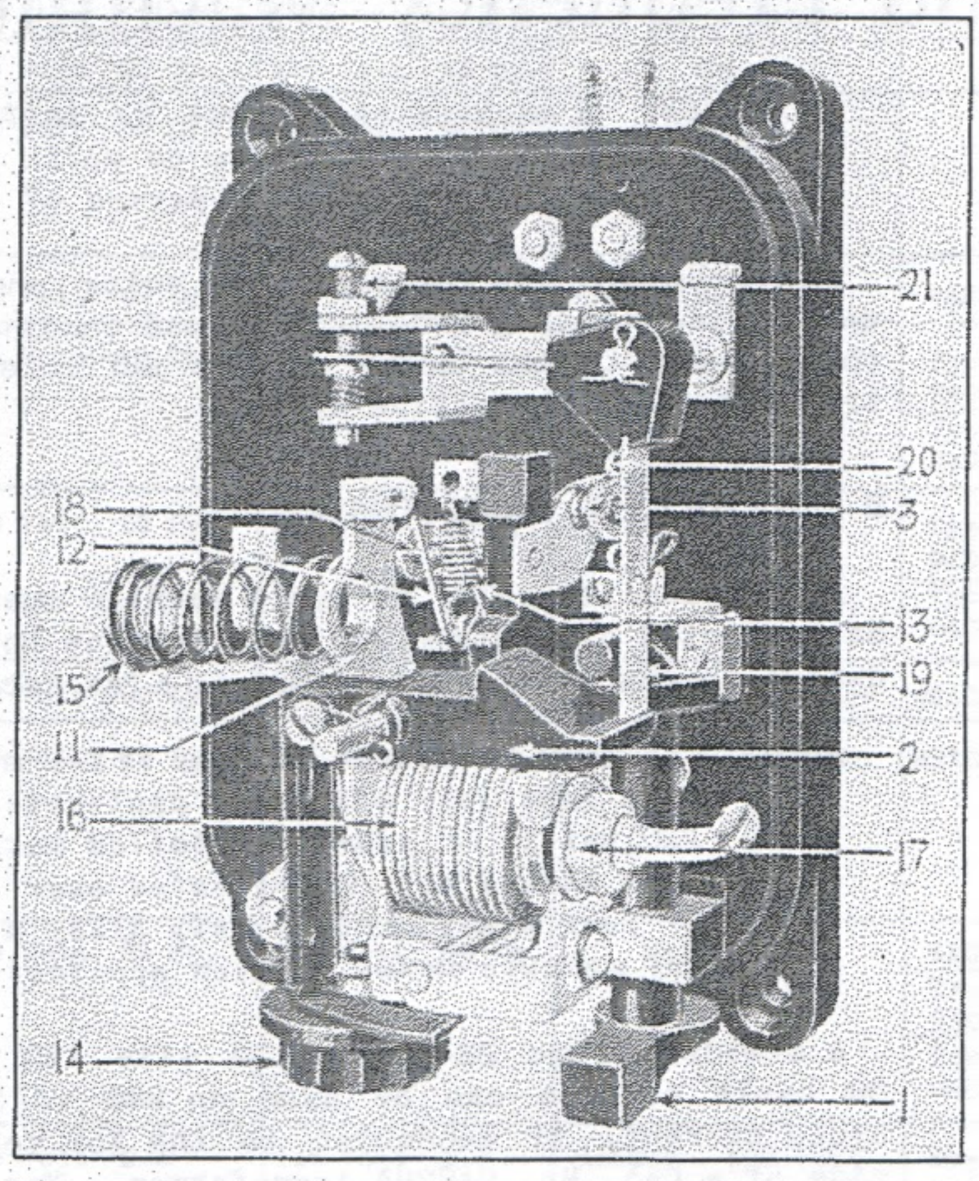


Fig. 101 Top View

1 Main Switch
2 Latch and Indicating Arm
3 Main Contacts
11 Lever for Automatic Control
12 Bridle
13 Bridle Spring for Contact Arm
14 Temperature Adjustment Knob
15 Temperature Adjustment Spring
16 Metallic Bellows
17 Clamp Nut on Bellows
18 Temperature Range Adjusting Screw
19 Overload Cut-out
20 Overload Heater
21 Overload Adjusting Screw

MOTOR CONNECTIONS	
No.	DA-1, DR-1, 2 & 3 Mach.
1	White
2	Brown or Green
3	Black
4	Red
See D-c Section	

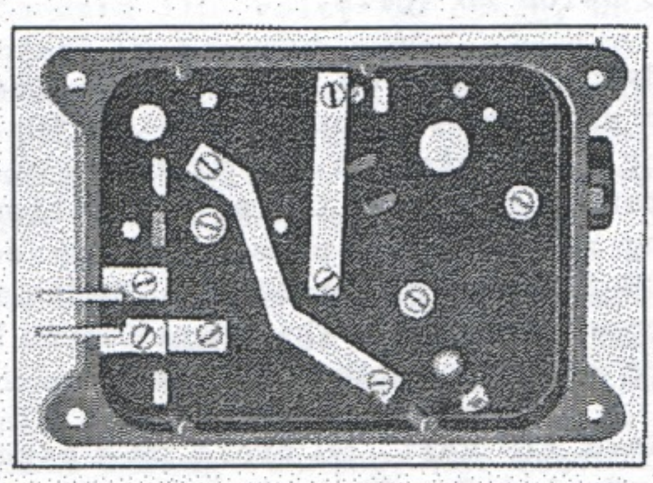


Fig. 105 Back View

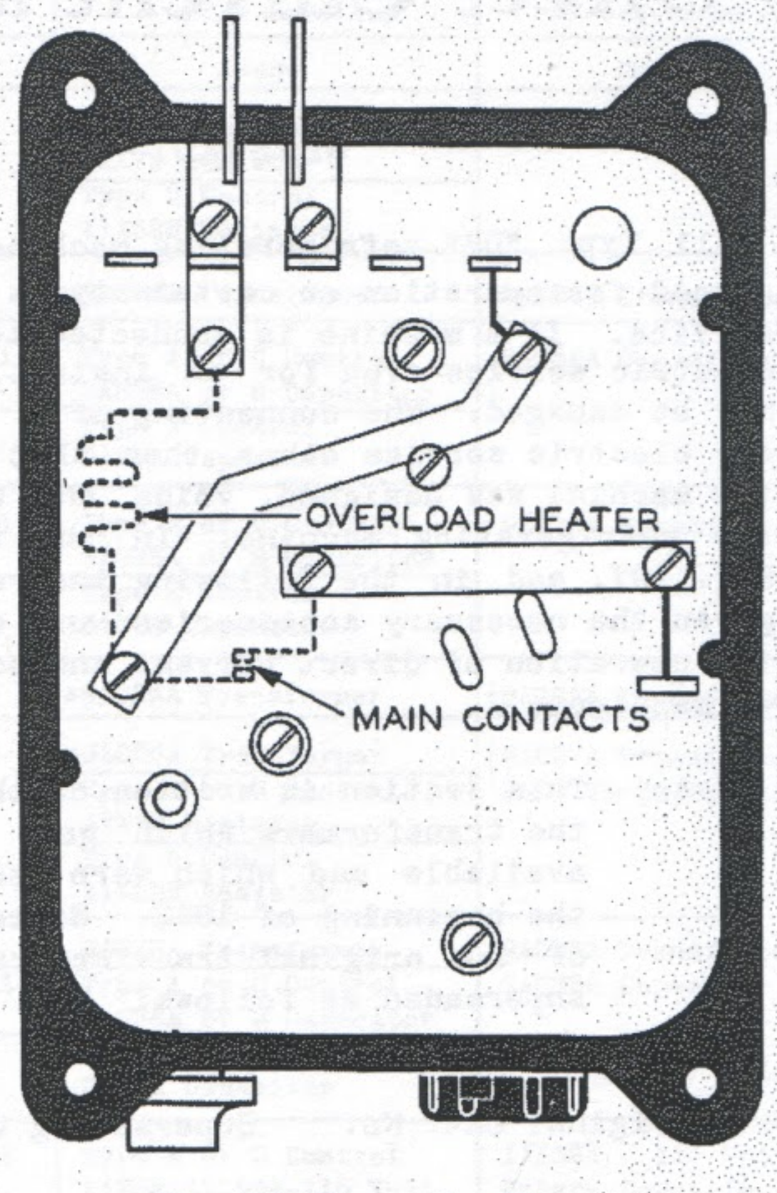


Fig. 102 Connection Diagram
See Fig. 108 for Schematic Wiring Diagram

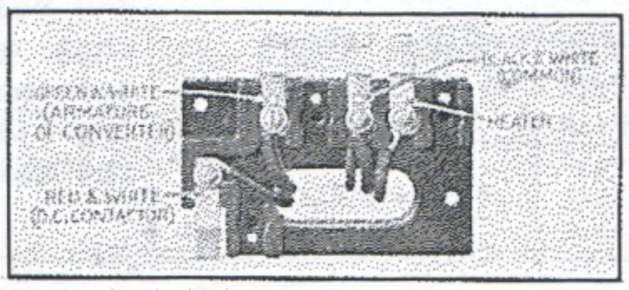


Fig. 103 Top View of Base Plate

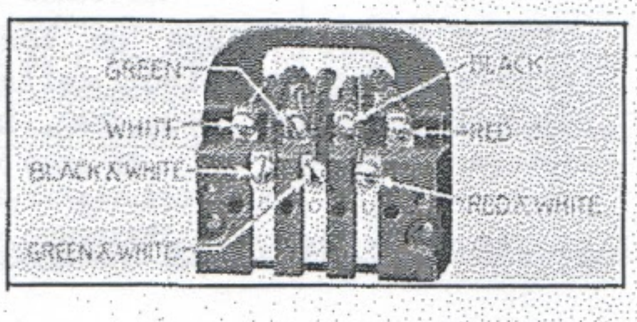


Fig. 104 Top View of Receptacle

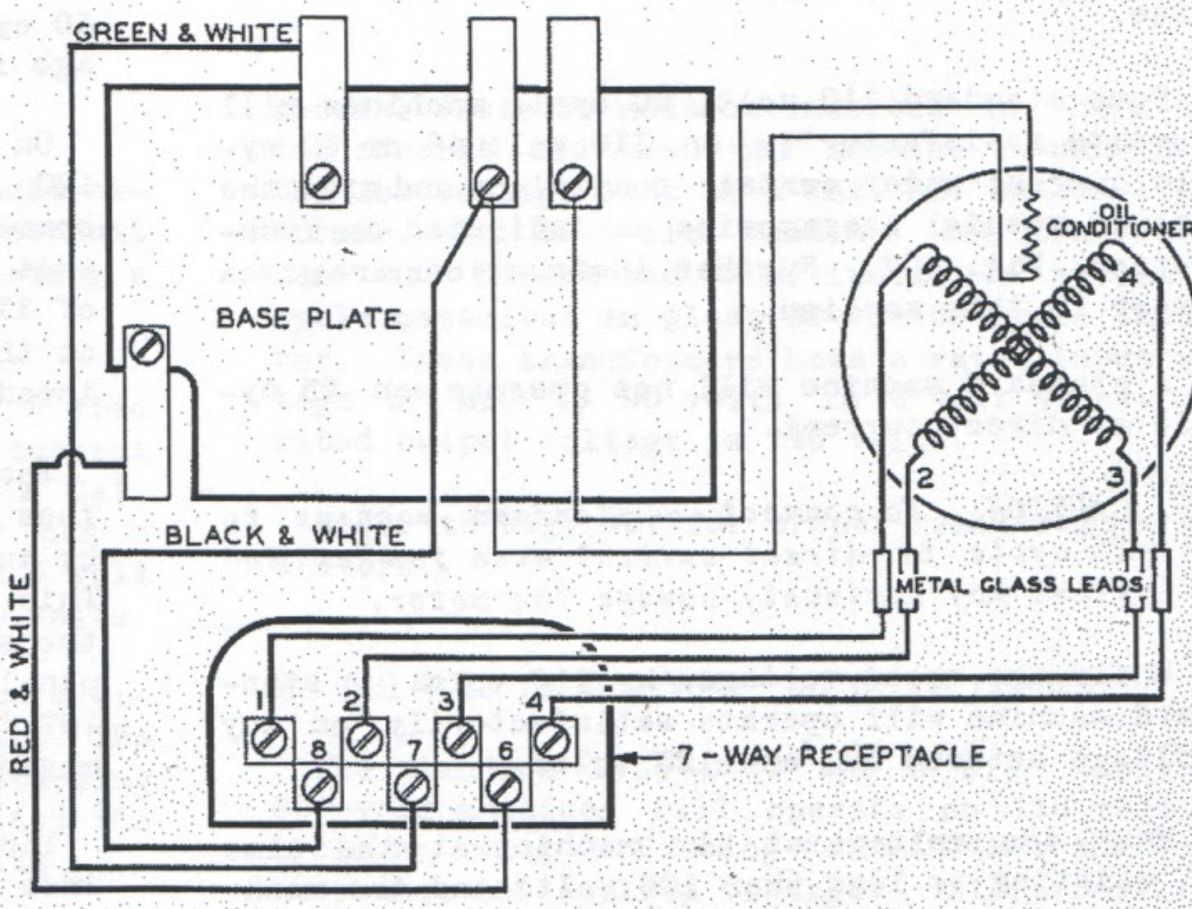


Fig. 106 Connection Diagram - Base Plate and Receptacle

Direct Current and Odd Frequency Machines

GENERAL

All Type "DR" refrigerating machines are designed for operation on certain types of electric service. If a machine is connected to the wrong electric service even for an instant, the motor may be damaged. The connecting of a machine to any electric service other than that for which the machine was designed, voids the warranty on the refrigerating machine. In the tabulation, Fig. 107, and in the following instructions are given the necessary accessories and changes for the operation of direct current and odd frequency machines.

Note – This section is written on the basis of the transformers which were originally available and which were used up until the beginning of 1942. Since then, two of the original transformers have been superseded as follows:

Original Cat. No.	Superseding Cat. No.
9AC26A	73G859
9AC27A	73G890

There are less taps on the superseding transformers. For an output voltage of 110 volts, input voltages are 240, 220, 200 and 180 volts.

A 110 VOLT, 60 CYCLE CURRENT

Standard Type DR machines are those designed for operation on 110 volt, 60 cycle electric service.

Some standard 110 volt, 60 cycle machines will operate satisfactorily on 110-volt 40 or 50 cycle current under certain conditions and with the use of special accessories as indicated in Tabulation, Fig. 107. Further instructions are given later in this section.

A standard machine will not operate on 25 cycle or direct current.

CAUTION: To connect a standard machine to 25 cycle or direct current even for an instant may seriously damage the motor.

While the rated voltage is 110 volts, a standard machine will operate satisfactorily on any voltage between 100 and 125 volts.

When the voltage at the machine at the time of starting is less than 100 volts and the machine is operating under heavy load conditions, it may not start and the motor protective device will trip off.

CAUTION: A machine should not be installed where the voltage goes below 90 volts periodically or for any extented period of time.

When the voltage is above 125 volts and the machine is operating under heavy load conditions, the current to the motor may be sufficient to trip the motor protective device.

B 220 VOLT, 60 CYCLE CURRENT

A standard 110 volt, 60 cycle machine must not be connected directly to 220 volt service because damage to the motor will result in a few seconds.

Note – The only exception allowed is the momentary (not over a second) application of 220 volts to start a stalled machine. This should not be repeated over three or four times and then only after allowing a minute or two between applications.

A standard Type DR-1, 2 or 3 size 110 volt, 60 cycle machine can be used on 220 volt, 60 cycle current, if connected to the low voltage side of a Cat. No. 9AC26A transformer. For DR-4 size machines use Cat. No. 9AC27A transformer. Connections are available in five-volt steps to take care of input voltages ranging from 90 to 240 volts. These connections should be made so that an average of 110 volts is applied to the machine. The minimum voltage to the machine during starting should not be less than 100 volts; the maximum during running not over 125 volts.

C 110 VOLT, 50 CYCLE CURRENT

The standard 110 volt, 60 cycle, DR-1 and 2 size machines can be used directly on 110 volt, 50 cycle current provided that the maximum voltage is not over 120 volts.

On circuits where the maximum voltage goes above 120 volts, transformer Cat. No. 9AM34A is recommended. This transformer is so constructed that the applied voltage is reduced by the ratio of 110 to 97 volts. The minimum applied voltage at the time the machine starts should not be allowed to go below 90 volts.

The standard 110 volt, 60 cycle, DR-3 size machines can be adapted for operation on 50 cycles by inserting a resistor in the starting circuit. This resistor is placed in the same position that the starting resistor is placed on the control panels of DR-1 and 2 size machines. Refer to Fig. 107 for proper resistor. The jumper must be removed before connecting the resistor.

The standard 110 volt, 60 cycle DR-4 size machines can be adapted for 50 cycle operation by installing a special 50 cycle capacitor in place of the 60 cycle capacitor. Refer to Fig. 107 for proper capacitor.

Electric Service Power Supply	*Standard Machine Required*	ADDITIONAL EQUIPMENT FOR MISCELLANEOUS ELECTRIC SERVICE POWER SUPPLY			
		DA-1 & DR-1 Machines	*DR-2 Machines*	*DR-3 Machines*	*DR-4 Machines*
110 Volt 60 Cy.	110 Volt 60 Cy.	None	None	None	None
110 Volt 50 Cy.	110 Volt 60 Cy.	None	None	Type A or C Control 11X79 Resistor Type E Control 11X529 Resistor	9AC319A Capacitor
110 Volt 40 Cy.	110 Volt 60 Cy.	Cannot be used	9AM34A Transformer	9AM34A Transformer	9AC28A Transformer
110 Volt 30 Cy.	110 Volt 25 Cy.	Machine not available	Type A or C Control 9AC37A Capacitor Type E Control 9AC5A Capacitor	Type A or C Control 9AC38A or B Capacitor Type E Control 9AC8A Capacitor	9AC38A Capacitor
110 Volt 25 Cy.	110 Volt 25 Cy.	Machine not available	Type A or C Control 9AC37A Capacitor Type E Control 9AC5A Capacitor	Type A or C Control 9AC38A or B Capacitor Type E Control 9AC8A Capacitor	9AC38A Capacitor
220 Volt 60 Cy.	110 Volt 60 Cy.	⊕9AC26A Transformer	⊕9AC26A Transformer	⊕9AC26A Transformer	†9AC27A Transformer
220 Volt 50 Cy.	110 Volt 60 Cy.	⊕9AC26A Transformer	⊕9AC26A Transformer	⊕9AC26A Transformer Type A or C Control 11X79 Resistor Type E Control 11X529 Resistor	†9AC27A Transformer 9AC319A Capacitor
220 Volt 25 Cy.	110 Volt 25 Cy.	Machine not available	9AC28A Transformer Type A or C Control 9AC37A Capacitor Type E Control 9AC5A Capacitor	9AC28A Transformer Type A or C Control 9AC38A or B Capacitor Type E Control 9AC8A Capacitor	9AC28A Transformer 9AC38A Capacitor
115 Volt D-c	115 Volt D-c	11X245 - 115 volt Rotary Converter 11X446 - 115 Volt Rotary Converter	Type A or C control 11X62;11X444-115 V. Rotary Converter Type E Control 11X245;11X446-115 V. Rotary Converter	Type A or C Control 11X62;11X444-115 Volt Rotary Converter Type E Control 11X245;11X446-115 Volt Rotary Converter	11X321 - 115 Volt Rotary Converter ‡9AC34A Transformer ‡9AC35A Transformer
230 Volt D-c	230 Volt D-c	11X356 - 230 Volt Rotary Converter 11X447 - 230 Volt Rotary Converter	Type A or C Control 11X124;11X445-115 V. Rotary Converter Type E Control 11X356;11X447-115 V. Rotary Converter	Type A or C Control 11X124;11X445-115 Volt Rotary Converter Type E Control 11X356;11X447-115 Volt Rotary Converter	11X320 - 230 Volt Rotary Converter ‡9AC34A Transformer ‡9AC35A Transformer

⊕Superseded by 73G859 †Superseded by 73G890

‡Depends on Rotary Converter and Refrigerating Machine what Transformer is required, if any.

Fig. 107 Equipment Necessary for Various Electric Service Power Supplies

D 220 VOLT, 50 CYCLE CURRENT

A standard 110 volt, 60 cycle machine must never be connected directly to a 220 volt circuit except, as noted in Section B, when starting a stalled machine.

Standard 110 volt, 60 cycle, DR-1 and 2 size machines can be used on 220 volt, 50 cycle current if connected to the low voltage side of a Cat. No. 9AC26A transformer. This transformer has a rated input voltage of 240 to 90 volts in 5 volt steps. The rated output voltage is 110 volts.

The connections should be so made that an average of 100 volts is applied to the machine. The minimum applied voltage at the time of starting should not be allowed to go below 90 volts; the maximum during running, not above 120 volts.

To operate standard 110 volt, 60 cycle DR-3 size machines on 220 volts, 50 cycle current, a special resistor must be inserted in the starting circuit and then the machine connected to the low voltage side of a Cat. No. 9AC26A transformer. For DR-4 size machines use transformer Cat. No. 9AC27A and then install a special 50 cycle capacitor in place of the 60 cycle capacitor. These transformers have a rated input voltage of 240 to 90 volts in 5 volt steps. The rated output voltage is 110 volts.

Refer to Fig. 107 for proper resistors and capacitors.

E 110 VOLT OR 220 VOLT, 40 CYCLE CURRENT

The standard Type DR-2 and 3 size 110 volt, 60 cycle machines will operate on 110 volt, 40 cycle by using a Catalog No. 9AM34A transformer to reduce the applied voltage. This transformer is so constructed that the applied voltage is reduced by the ratio of 110 to 97 volts.

For 220 volt, 40 cycle current, use a Cat. No. 9AC26A Transformer. It should be connected so that there is approximately 95 volts applied to the machine. This transformer has a rated input voltage of 240 to 90 volts in 5 volt steps. The rated output voltage is 110 volts. Since the rated output voltage of the transformer is 110 volts, the tap connections must be made for approximately 20 volts higher than the line voltage.

When a standard 60 cycle machine is used on 40 cycle current, the capacity is reduced by one-third since the speed of the motor is reduced by the ratio of 60 to 40 because of the lower frequency electric service.

A standard 110 volt, 60 cycle machine must never be connected directly to a 220 volt, 40 cycle circuit as the motor will be damaged in a few seconds.

F 110 VOLT, 25 AND 30 CYCLE CURRENT

Special machines were designed for use on 110 volt, 25 cycle electric service.

These machines can be used on 30 cycle service, but they cannot be used on anything except 110 volt, 25 or 30 cycle current electric service.

The rated voltage is 110 volts but the machines will operate on a maximum of 125 volts and minimum of 100 volts.

On these 25 cycle machines a special capacitor is required. This capacitor is separate and connection is made by plugging the cord attached to it into the receptacle on the back of the control panel or cabinet top.

Refer to Fig. 107 for the proper capacitor.

G 220 VOLT, 25 AND 30 CYCLE CURRENT

The special 110-volt, 25 cycle machines listed above under Section F must never be connected directly to 220 volt service except as noted in Section B when starting a stalled machine.

However, the 110 volt, 25 cycle machines can be used on 220 volt, 25 cycle current when connected to the low voltage side of a Cat. No. 9AC28A transformer, and by using the special 25 cycle capacitor. This transformer has a rated input voltage of 240 to 90 volts in 5 volt steps. The rated output voltage is 110 volts.

The connections to the transformer should be made so that an average voltage of 110 volts is applied to the machine with a minimum of 100 volts during the starting period and a maximum of 125 volts while running.

The capacitor is separate and is connected to the machine through the receptacle on the back of the control panel or cabinet top.

Refer to Fig. 107 for the proper capacitor.

H 115 OR 230 VOLT, DIRECT CURRENT

Special machines were designed for use on direct current electric service. However, a rotary converter must also be used with these machines since the motor in the machine is for alternating current. The rotary converter furnishes alternating current converted from the direct current supply.

The DR-1, 2, and 3 size machines have a 2-phase motor, and the DR-4 size machines have a 3-phase motor. Because of the two individual phases for the motors in the DR-1, 2, and 3 size machines, it is necessary to bring out the motor leads through four separate metal glass leads in the compressor base. Only three metal glass leads are necessary for the three phase motor in the DR-4 size machines.

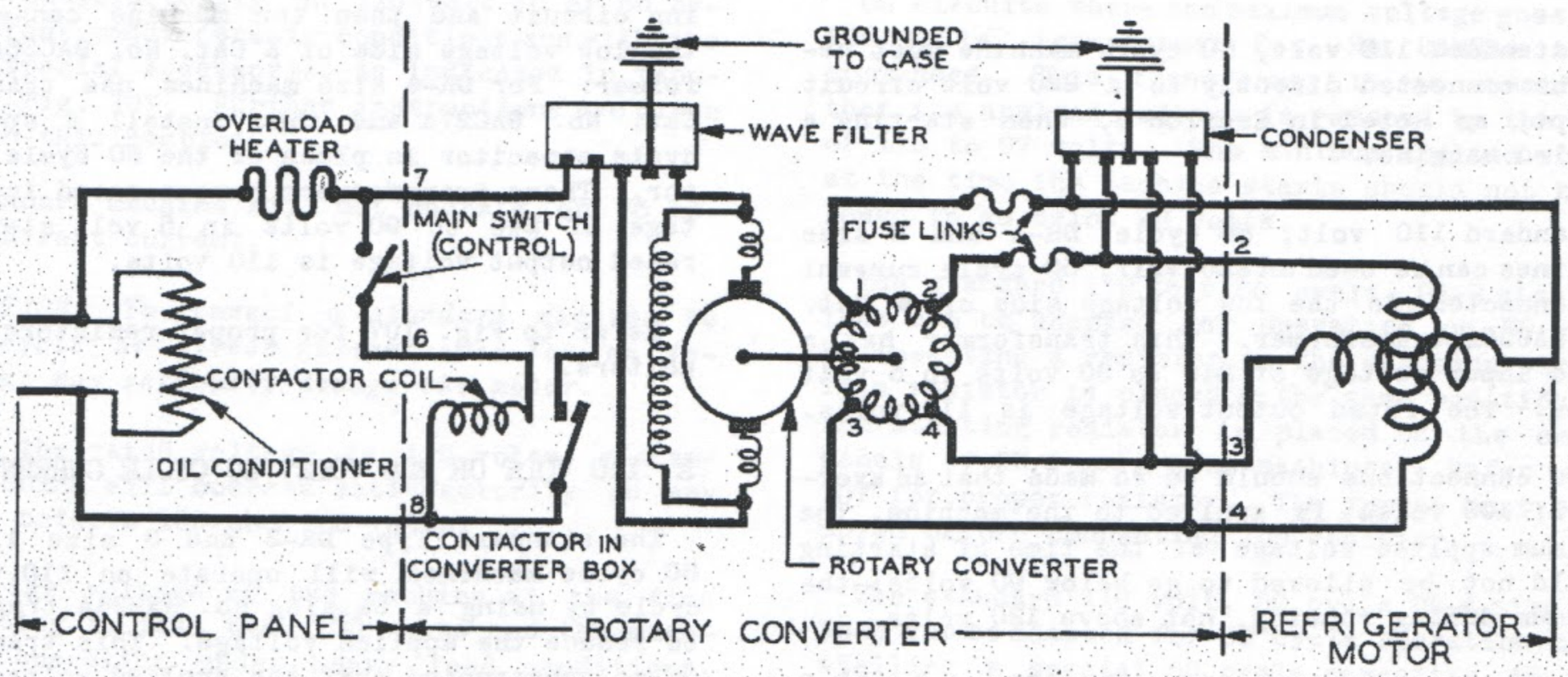


Fig. 108 Schematic Wiring Diagram for Direct Current Machines

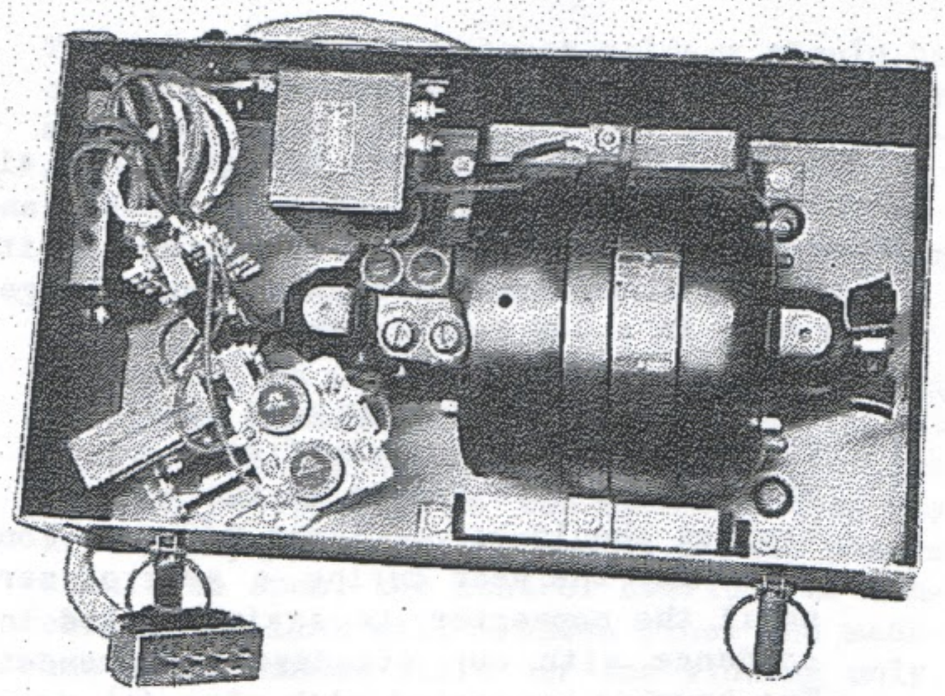


Fig. 109 Rotary Converter

The compressor is identical in every other detail with the standard 110 volt, 60 cycle machine.

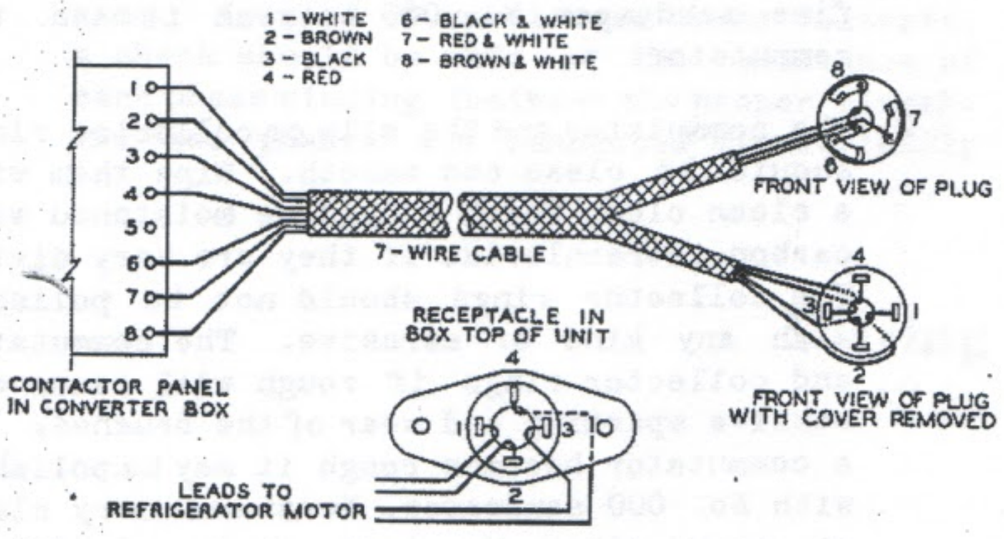


Fig. 110

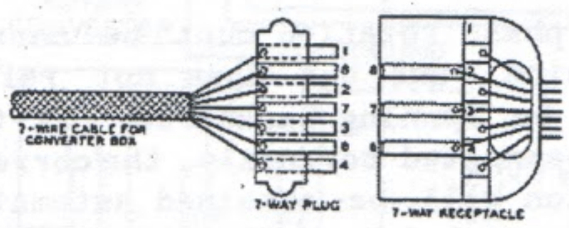


Fig. 111

The controls differ from the standard 110 volt, 60 cycle controls in that there is no starting relay mechanism since the polyphase motors do not require a starting circuit or special winding. However, the controls are made so that there is a mid-tap between the main switch contacts and the overload heater. The purpose of this connection is to place the overload heater in the main line and the contacts in the contactor coil circuit.

A schematic diagram is shown in Fig. 108 indicating the control, rotary converter, and machine motor for Type DR-1, 2 and 3 size machines.

These rotary converters use the standard seven-wire converter cable for connection to the machine. At the end of the seven-wire cable the early rotary converters had a three-way plug and a four-way plug, the first which was plugged in-

to the control, and the second which was plugged into the receptacle on the machine cabinet top. Later a seven-way plug was used and was plugged into a seven-way receptacle on the machine cabinet top. In case it is necessary to interchange these plugs Figs. 110 and 111 show the wiring

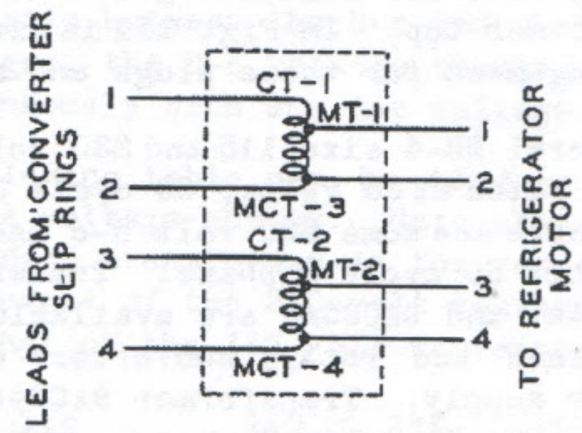


Fig. 112 2-Phase Auto-Transformer

arrangement for the various plugs and receptacles. The leads are numbered according to the scheme shown in Fig. 108. The colors for the various leads are shown in Fig. 110. The contactor panel connections are the same regardless of the type of plugs and receptacles.

The wiring diagram for the 230 volt direct current machines is the same except that there is an approximate two to one step-down transformer between the output of the converter and the machine motor which steps the 230 volt converter output of 2 phase, 160 volts, 60 cycles, down to 80 volts on each phase. This transformer is located in the 230 volt converter box. In Fig. 112 is shown a schematic diagram of the step down transformer.

Note: When 115 and 230 volt converters are interchanged, be sure to change the overload heater in the control and the oil conditioner in the base of the machine.

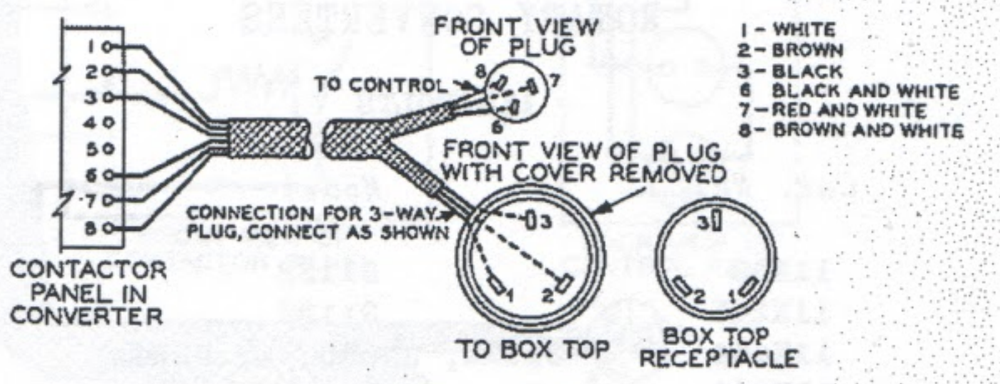


Fig. 113

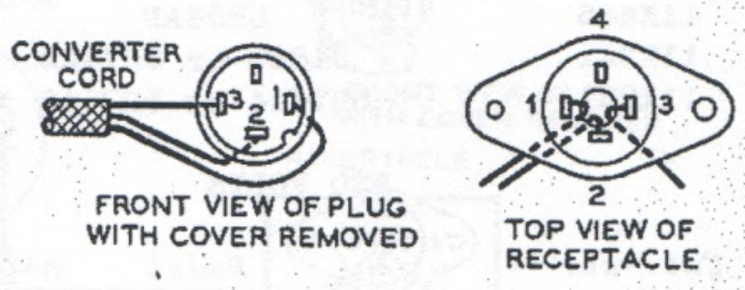


Fig. 114

The DR-4 size machines use a rotary converter which delivers three phase instead of two phase power as is the case with the DR-1, 2, and 3 size machines. The schematic wiring diagram is essentially the same as that for the two phase rotary converters. The difference is that only

three wires go from the A-c end of the converter to the refrigerating machine motor. Fig.113 gives the connections for the plugs and receptacles.

A few machines were made with a four-way plug and receptacle for connecting the converter cord to the cabinet top. In Fig. 114 is given the wiring arrangement for these plugs and receptacles.

In general DR-4 size 115 and 230 volt D-c machines are rated at 65 volts, 60 cycle 3 phase, although there are some 230 volt d-c machines rated at 138 volt 60 cycle 3 phase. Transformers Cat. No. 9AC34A1 and 9AC35A1 are available for adapting machines and rotary converters depending on the power supply. Transformer 9AC34A1 is rated 133 volts to 71 volts 3 phase, and transformer 9AC35A1 is rated 65 volts to 155 volts, 3 phase.

When making service adjustments to these machines refer to the rotary converter catalog number as used on that particular machine to determine what voltage or transformer is required for that particular refrigerating machine motor.

ROTARY CONVERTERS

Each rotary converter is assembled in a steel case with the necessary connecting cord and plugs, and is identified as to its use by a catalog number. However, for a complete mechanical identification both the catalog and model number of the converter must be given. The following tabulation lists the various catalog and model numbers of the rotary converters. The wiring diagrams for these converters are given in Figs. 115 to 121 inclusive. In using the wiring diagrams it is necessary that the catalog number and the model number of the converter itself check with the information given in the tabulation.

ROTARY CONVERTERS

115 VOLTS

Cat. No.	*Model*
11X62	31122
11X245	31122
11X444	31122, 35650, or 5H54A1
11X444	5H54A10
11X446	31122, 35650, or 5H54A1
11X446	5H54A9
11X321	34888 or 5H74A2
11X321	5H74A4 or 5H74A6

230 VOLTS

Cat. No.	*Model*
11X445	33226, 37582, or 5H54A2
11X445	5H54A6
11X447	33226, 37582, or 5H54A2
11X447	5H54A7
11X356	33226
11X124	33226
11X320	34887 or 5H74A1
11X320	5H74A3 or 5H74A7

INSTALLATION AND SERVICE

The following suggestions are given to aid in checking the converter in case of trouble and in maintaining the converter in operating condition. It is recommended that repairs and changes be made only in a G-E Service Shop.

1 The brushes should be in good condition, sufficiently long, properly fitted to the commutator and move freely in the holders. The brushes should be at least 5/8 inch long to allow for the wear during a year of service until the converter is again checked in accordance with our standard recommendation. The brushes are marked with plus (+) or minus (-) marks. When installing new brushes, the mark should be on top of the brush, with the brush marked plus on the left side facing the commutator end of the converter. If a brush does not fit the curvature of the commutator, it may be sanded down by drawing a piece of fine sandpaper No. 000 between it and the commutator.

2 The commutator and the slip or collector rings should be clean and smooth. Wipe them with a clean cloth which should be moistened with carbon-tetrachloride if they are very dirty. The collector rings should not be polished with any kind of abrasive. The commutator and collector rings if rough will cause excessive sparking and wear of the brushes. If a commutator becomes rough it may be polished with No. 000 sandpaper. Never use emery cloth or paper since the emery is an electrical conductor and particles of it might short commutator segments.

3 The phase rotation must be correct. If the machine runs but does not refrigerate, it may be running backwards. If the converter is connected correctly, the correct phase rotation will be obtained automatically. The leads marked 1, 2, 3 and 4 coming from the converter flange are connected through No. 1, 2, 3 and 4 collector rings numbering from the collector bearing toward the armature.

4 The converter should have a pair of fuse links, thermal cut-outs or Fusestats installed, one in each phase of the converter. (In lines No. 1 and 2 - see the Wiring Diagrams). The first converters did not have these fuse links. In case one phase of the converter output should have an open circuit, for instance due to a poor brush contact, the other phase of the unit motor will be protected from being burned out.

5 It is advisable to check the oil in the bearings by adding 300 drops (about 2/3 cu. in.) to each bearing. Any surplus oil will be drained out of the overflow on the bearing housing. Only a good grade of light weight (S.A.E.10) oil should be used. Household converters should be oiled once every year with this amount of oil. The original factory oil charge was three times this amount.

6 The condition of the brush holders should be checked. If they show signs of turning, they should be lined up and their set screws tightened.

7 The operation and condition of the contactor in the converter case should be checked.

8 The condition of the converter cable and plug should be checked. If the plug prongs do not make a good tight contact with the terminals in the receptacle on the machine, they may arc and spark. Also, if one of the A-c phases should be open, the control overload or converter fuse link will be blown since the machine motor cannot start on one winding only.

9 The interior of the converter case and the converter itself should be cleaned out if they are dirty and dusty.

10 Converter Output Voltage - The volts measured on each phase should be approximately the same. In case of unbalanced phase voltages, a check should be made of the resistance of each phase winding (between the proper rings). The two phases are connected diametrically across the converter and the resistance should be nearly the same. When checking the A-c voltages, the load (the refrigerating machine) should be connected and operating. No load voltages (refrigerating machine not operating) are somewhat higher. Since there is a definite ratio between the D-c and A-c converter voltages, the D-c voltage should be taken simultaneously with any A-c voltage.

The following table may be used as a guide in making the voltage checks. Note that because of the step down transformer in the converter case, the A-c output of the 230 volt converter is the same as that of the 115 volt converter.

D-c Volts	110 220	115 230	120 240	125 250
A-c phase volts (1-3 2-4)	78	81.5	85	88.5

In the case of Type DR-4 three-phase machines the voltage should be approximately the same across any two rings. It should be either 65 or 138 volts depending upon the model and catalog number of the rotary converter.

Wiring Diagrams

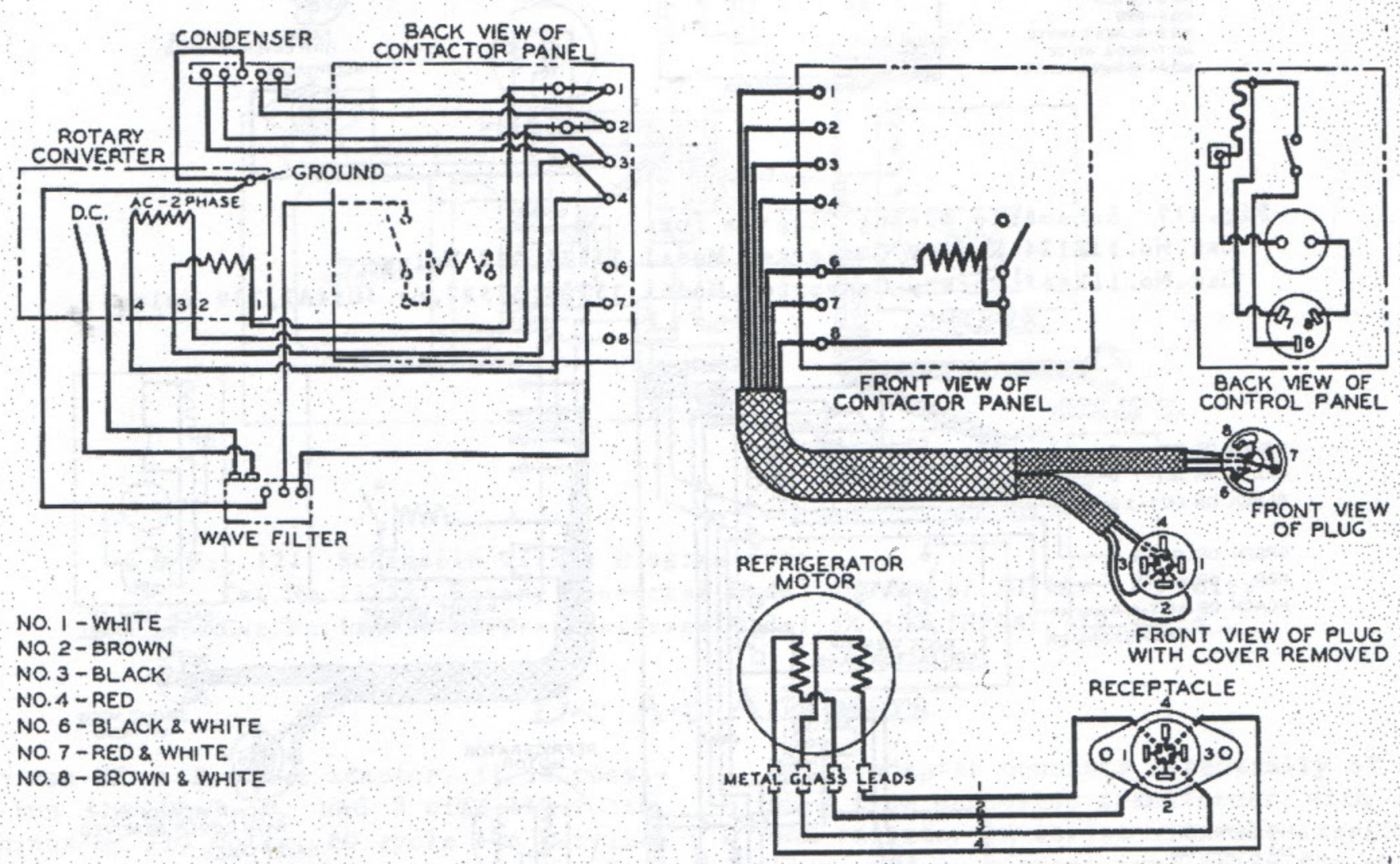


Fig. 115 Schematic Wiring Diagram for:
Cat. No. 11X62 Rotary Converter Model 31122, 115 Volts
Cat. No. 11X444 Rotary Converter Model 3112, 35650, 5H54A1, or 5H54A10, 115 Volts

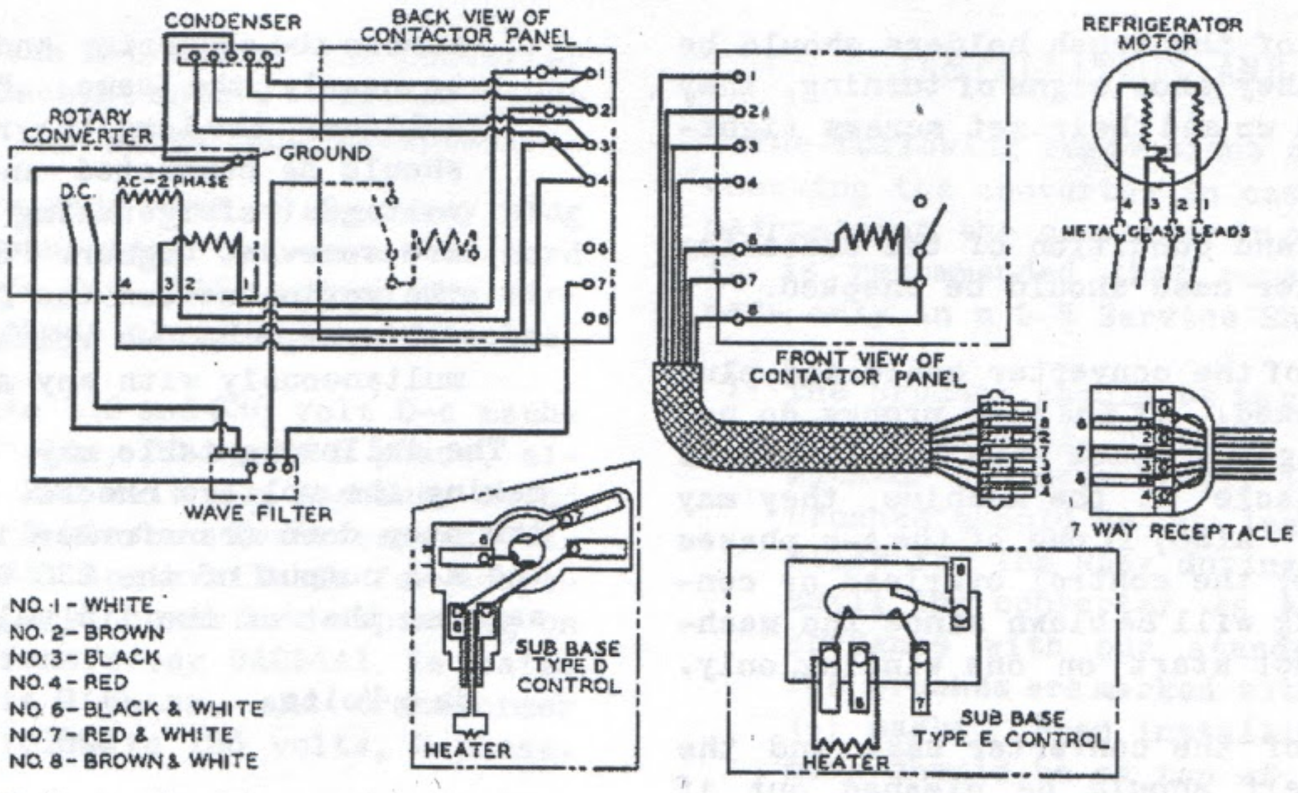


Fig. 116 Schematic Wiring Diagram for:
Cat. No. 11X245 Rotary Converter Model 31122, 115 Volts
Cat. No. 11X446 Rotary Converter Model 31122, 35650, 5H54A1, or 5H54A9, 115 Volts

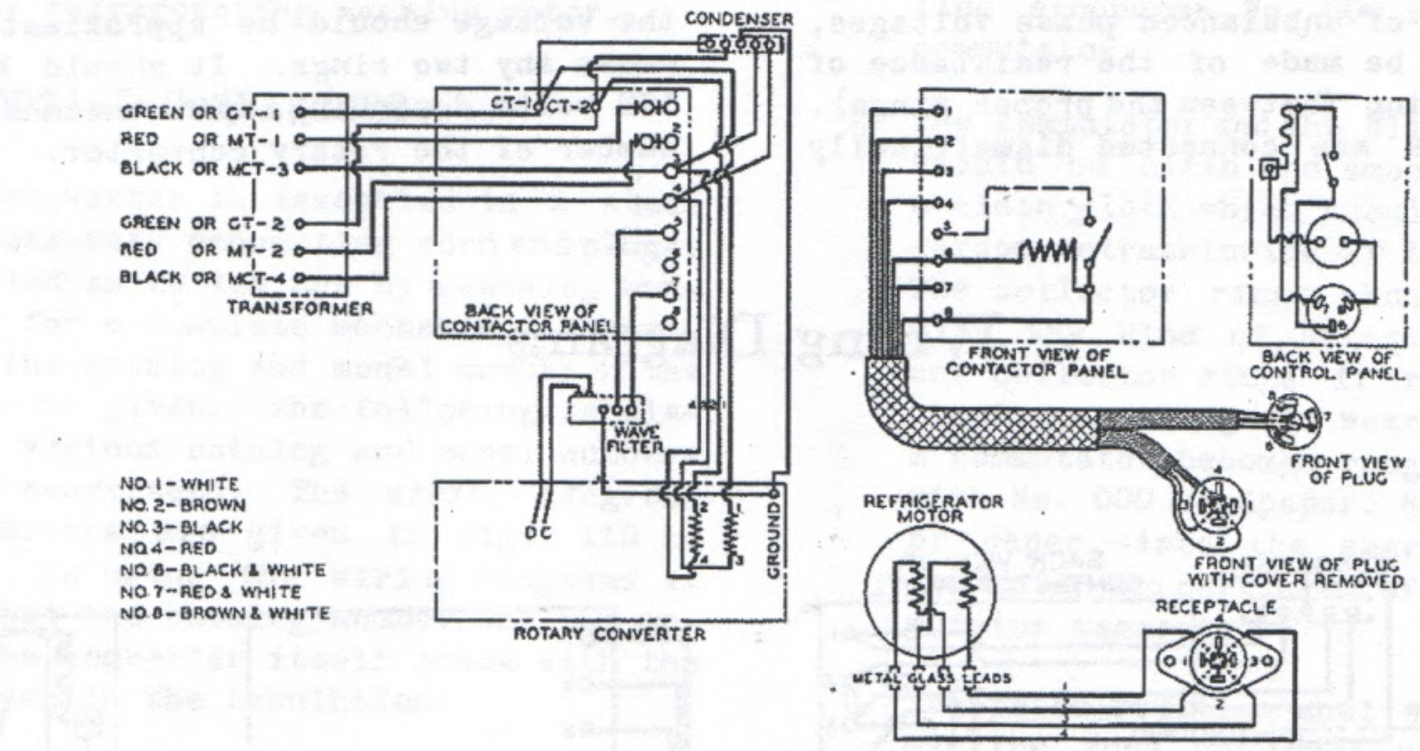


Fig. 117 Schematic Wiring Diagram for:
Cat. No. 11X124 Rotary Converter Model 33226, 230 Volts
Cat. No. 11X445 Rotary Converter Model 33226, 37582, or 5H54A2, 230 Volts

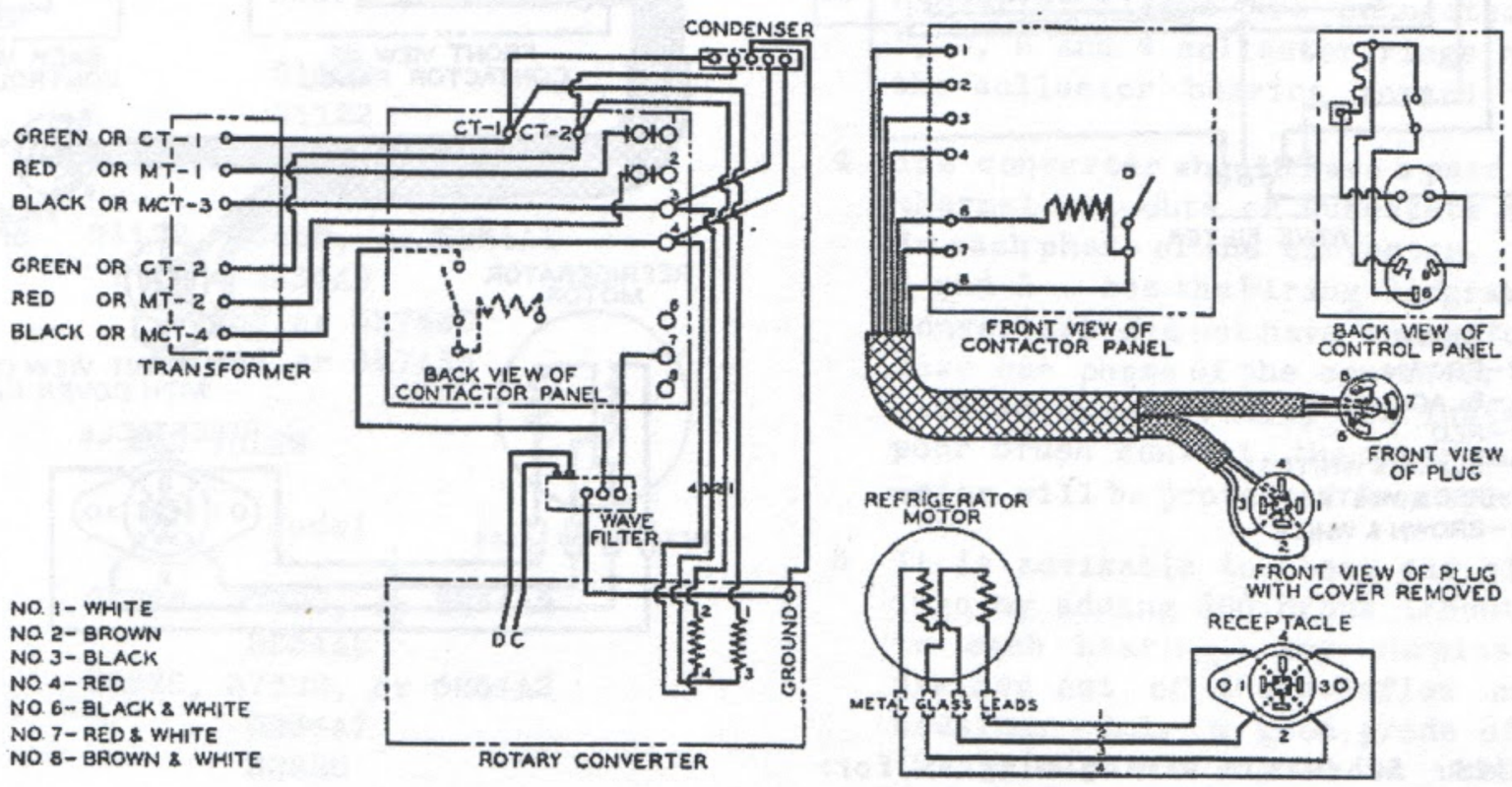


Fig. 118 Schematic Wiring Diagram for:
Cat. No. 11X445 Rotary Converter Model 5H54A6, 230 Volts

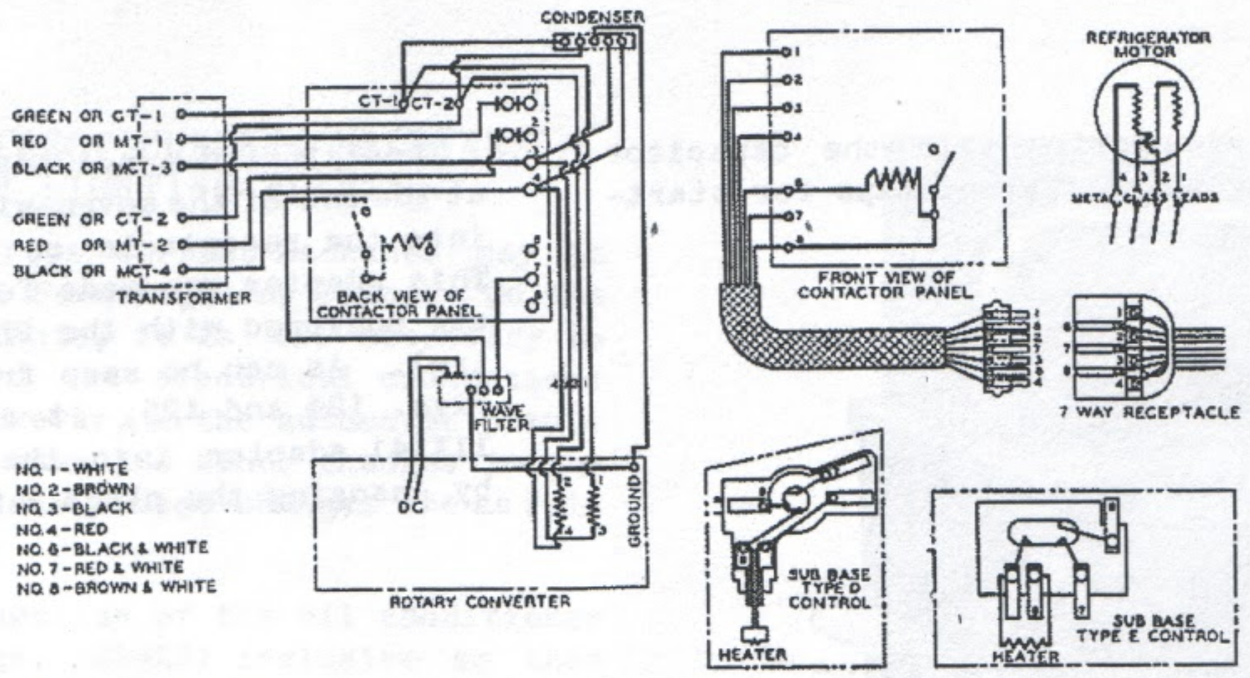


Fig. 119 Schematic Wiring Diagram for:
Cat. No. 11X356 Rotary Converter Model 33226, 230 Volts
Cat. No. 11X447 Rotary Converter Model 33226, 37582, 5H54A2, or 5H54A7, 230 Volts

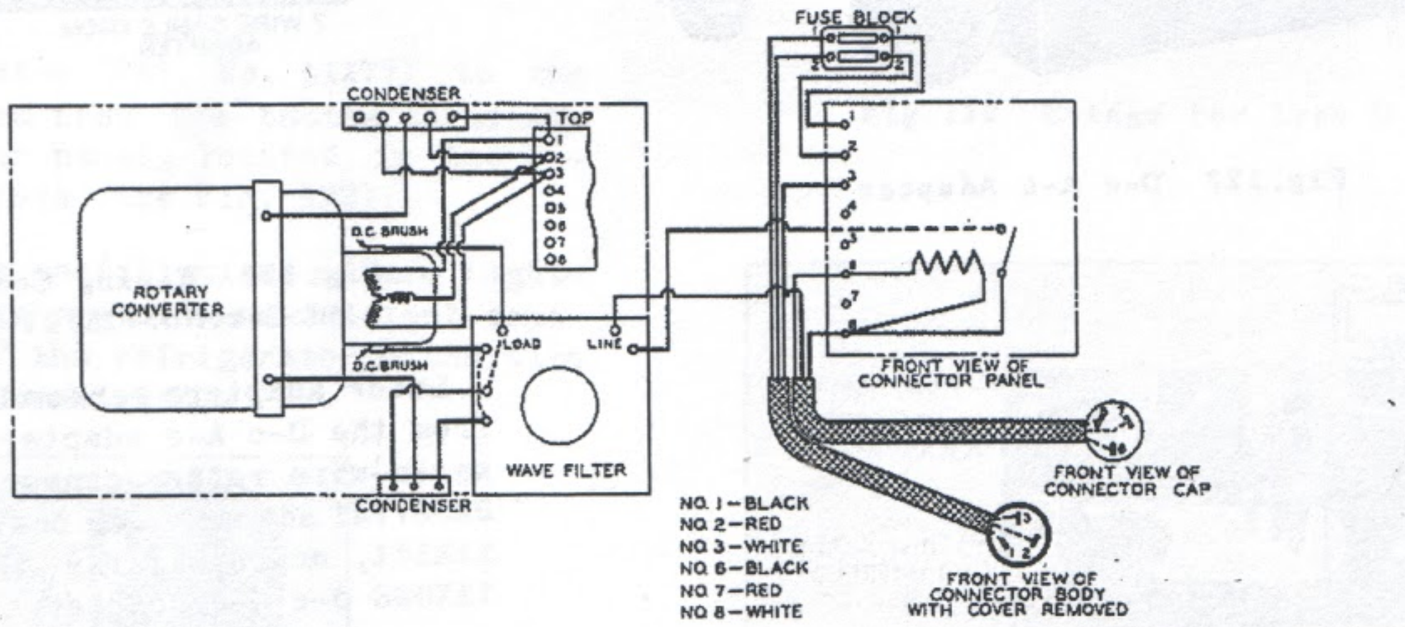


Fig. 120 Schematic Wiring Diagram for:
Cat. No. 11X321 Rotary Converter Model 34888, or 5H74A2, 115 Volts
Cat. No. 11X320 Rotary Converter Model 34887, or 5H74A1, 230 Volts

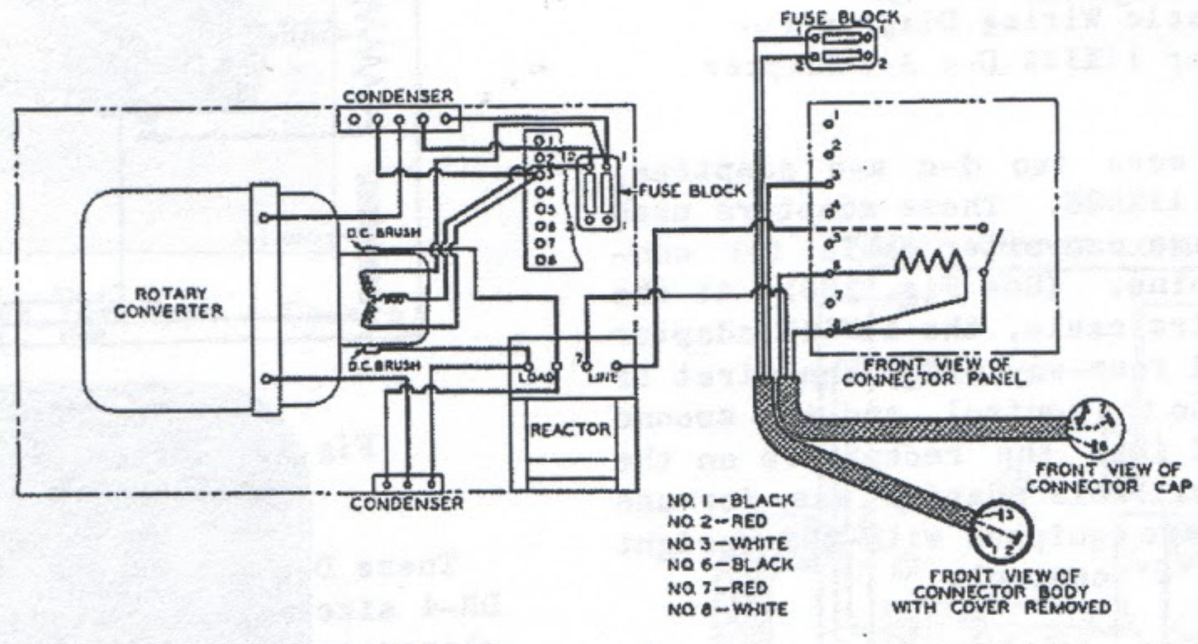


Fig. 121 Schematic Wiring Diagram for:
Cat. No. 11X321 Rotary Converter Model 5H74A4, or 5H74A6, 115 Volts
Cat. No. 11X320 Rotary Converter Model 5H74A3, 5H74A7, 230 Volts

D-c A-c Adapters

By the use of a D-c A-c adapter, it is possible to run the DR-1, 2, and 3 size 115 volts, D-c machines on 110 volts, 60 cycle A-c service. The adapter is plugged into the machine in place of the rotary converter The use of Cat. No. 9AM34A transformer on the power supply side of the adapter to reduce the line voltage permits the operation of the machines on 110 Volt, 50 cycle electric service.

The adapter consists essentially of a standard DR-3 type capacitor transformer with a six (6) ohm resistor in series with the starting connection, and a current type relay for changing the connection on the transformer from the starting to the running connection. Line voltage is applied directly to one winding of the motor. The second winding of the motor as in the case of a standard DR-3 60 cycle machine, becomes the

starting winding in series with the capacitor transformer, using the different taps for starting and running.

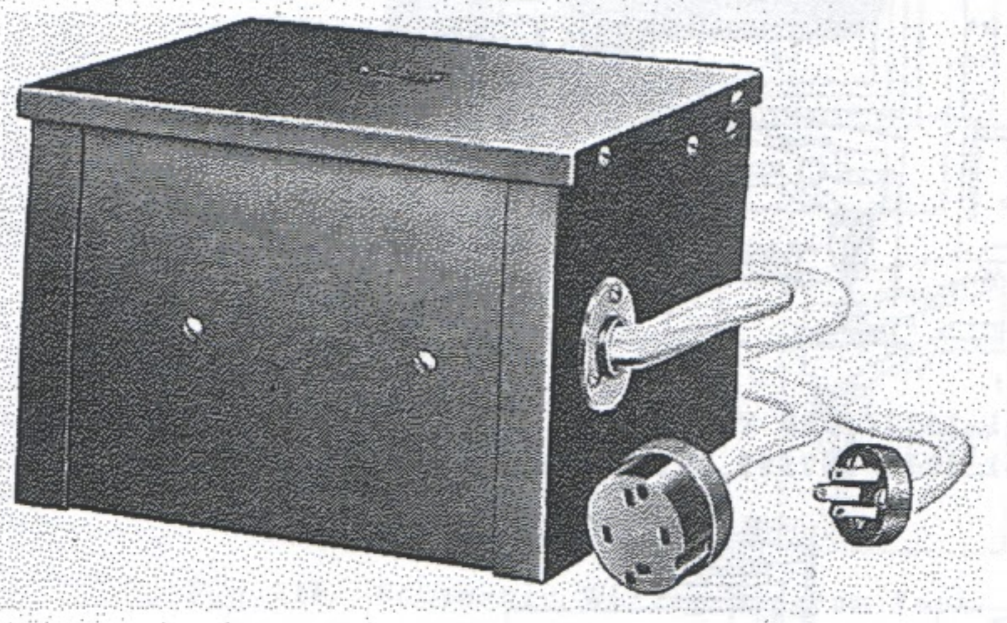


Fig. 122 D-c A-c Adapter

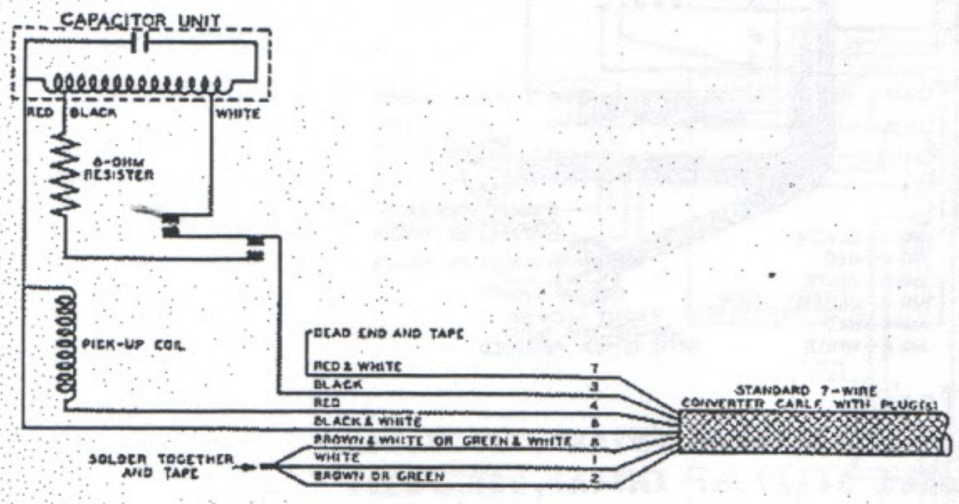


Fig. 123 Schematic Wiring Diagram for Cat. No. 11X141 or 11X528 D-c A-c Adapter

Originally there were two d-c a-c adapters, Cat. Nos. 11X141 and 11X528. These adapters used a standard seven-wire converter cable for connection to the machine. (See Fig. 123) At the end of the seven-wire cable, the 11X141 adapter had a three-way and four-way plug, the first of which is plugged into the control, and the second of which is plugged into the receptacle on the machine cabinet top. This adapter was for use with machines which are equipped with the upright CR-1050 Type "A" or "C" control.

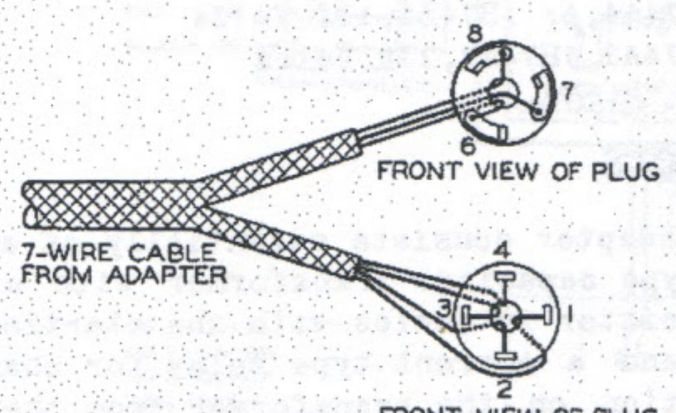


Fig. 124 Wiring Connection for Plugs on Cat. No. 11X141 D-c A-c Adapter

The 11X528 d-c a-c adapter has a seven-way plug at the end of the seven-wire cable which is plugged into the receptacle on the machine cabinet top. This adapter was made for use on machines which are equipped with the flat CR-1050 Type "E" control. As can be seen from the wiring diagrams, Figs. 124 and 125, it is possible to change an 11X141 adapter into the 11X528, and vice-versa by changing the plugs at the end of the cable.

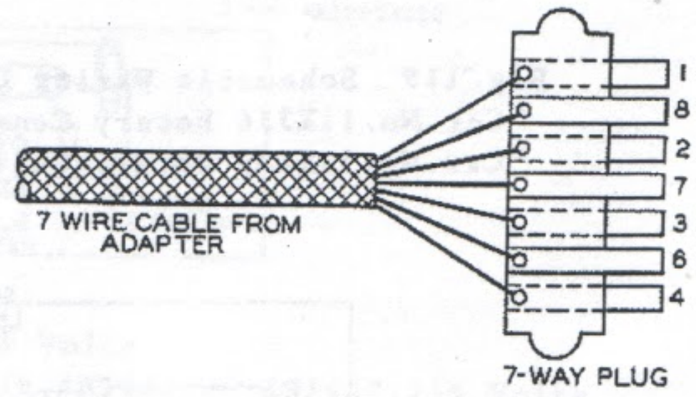


Fig. 125 Wiring Connection for Plugs on Cat. No. 11X528 D-c A-c Adapter

Later adapters were made with a three-wire cable from the D-c A-c adapter box instead of the old seven-wire rotary converter cable. The Cat. No. 9AC277A1 adapter with the 3-wire cable replaces the 11X141, and similarly the 9AC277B1 replaces the 11X528 d-c a-c adapter. (See Figs. 126 and 127)

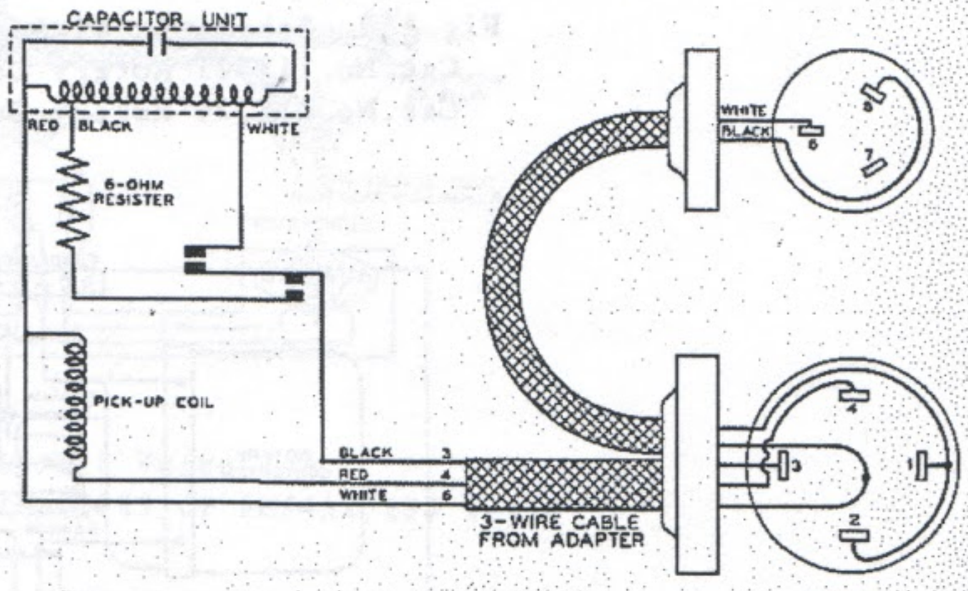


Fig. 126 Schematic Wiring Diagram for 9AC277A1 D-c A-c Adapter

These D-c A-c adapters cannot be used with the DR-4 size machines since the motors in these machines are three phase motors.

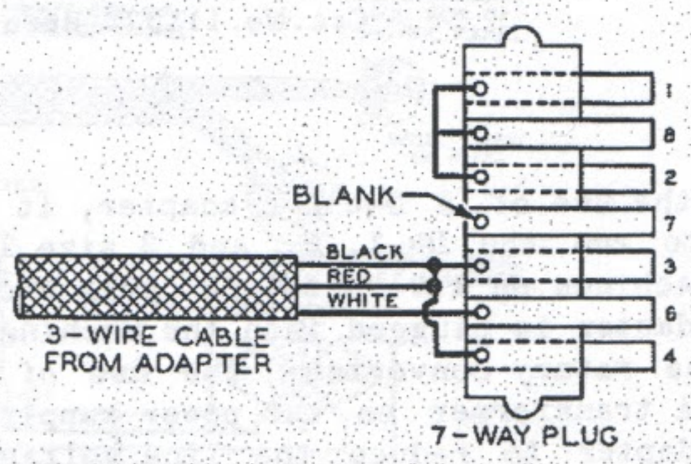


Fig. 127 Wiring Connections for Plug on 9AC277B1 D-c A-c Adapter

OPERATION OF DIRECT CURRENT MACHINES ON FARM LIGHTING PLANTS

The 110 Volt direct current machines may be operated on 110 volt Farm Lighting Plants. On the battery type of plants, it is not necessary to make any changes in the electrical connections of the machine. However, on the automatic plants it is necessary to make two minor changes in the electrical connections. These changes are as follows:

A Change one connection of the oil conditioner as shown in Figs. 128-131 inclusive so that it is disconnected whenever the machine stops. If this is not done, the load taken by the oil conditioner may be sufficient to keep the plant running continuously.

B Connect a resistor (Cat. No. 11X77) to the bottom and third from the bottom terminals on the contactor panel, located in the rotary converter case (See Fig. 132)

Be sure when making installations on Farm Lighting Plants that the generator has sufficient capacity to take care of the refrigerator in addition to the rest of its normal load.

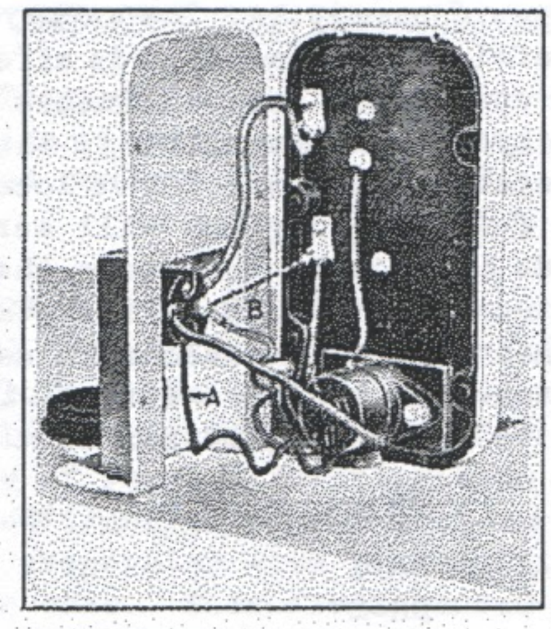


Fig. 128 Change for Type A Control

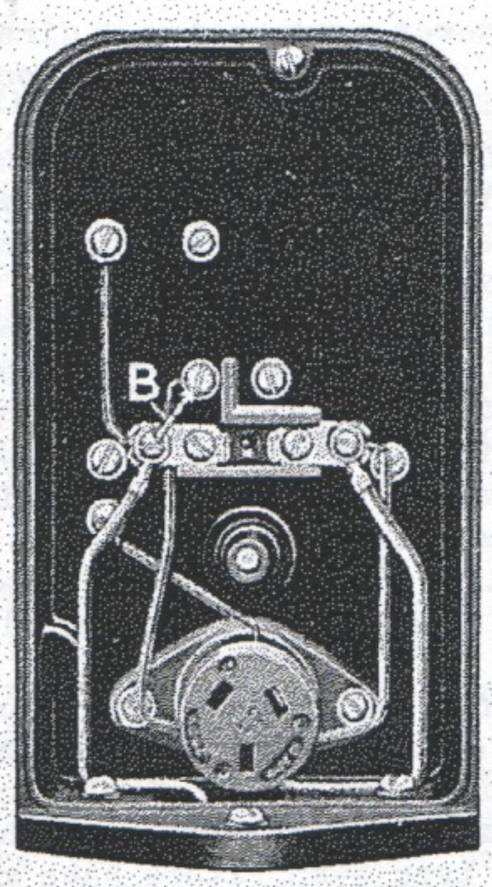


Fig. 129 Change for Type C Control

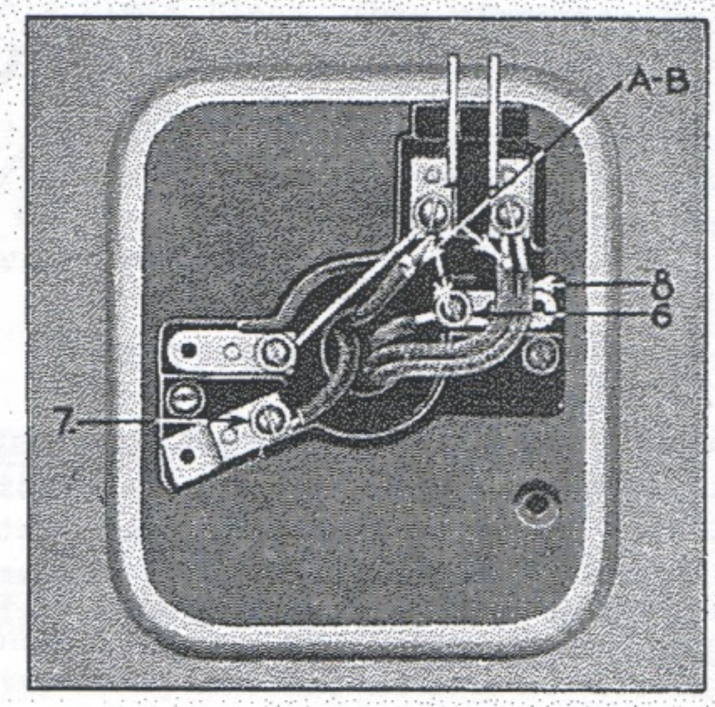


Fig. 130 Change for Type D Control

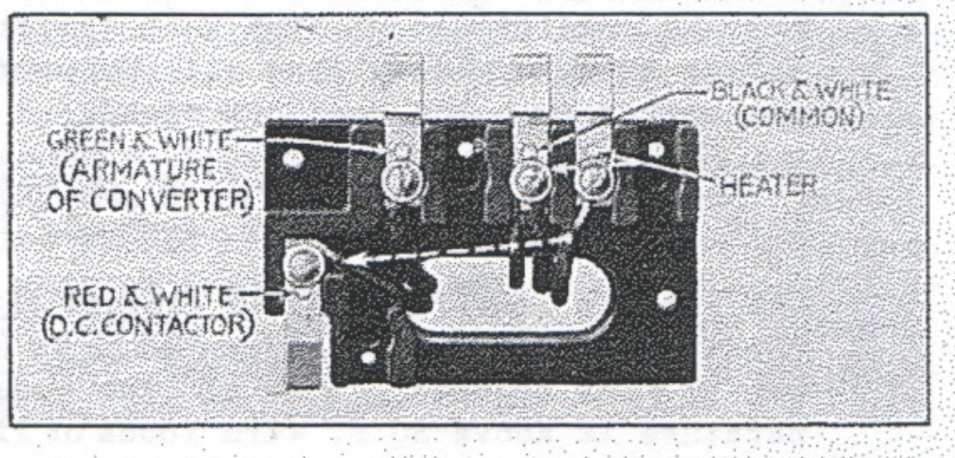


Fig. 131 Change for Type E Control

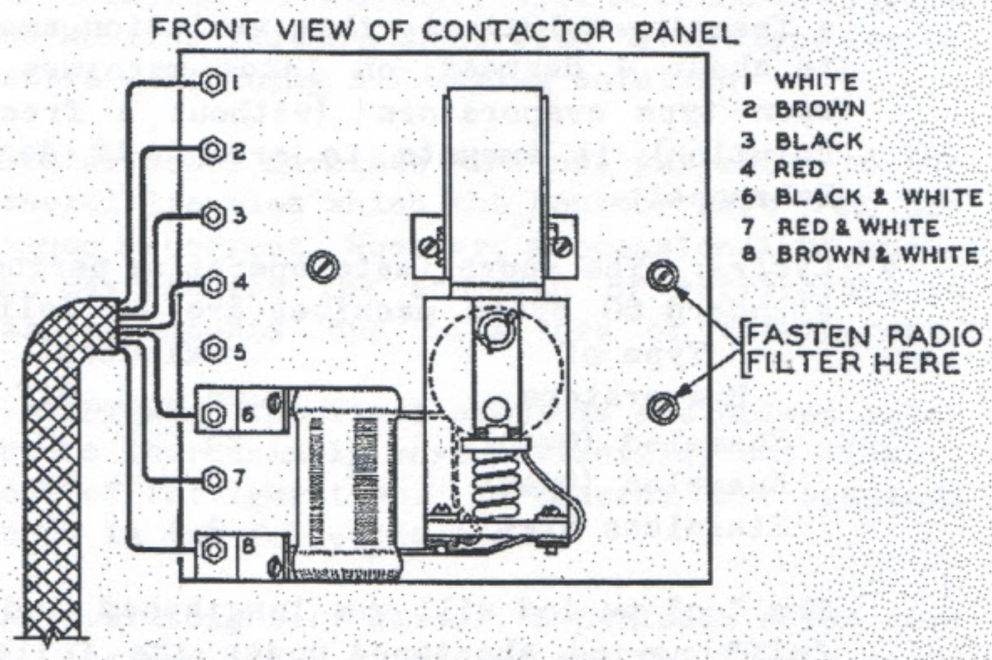


Fig. 132 Connection of Resistor to Panel Board in Rotary Converter Case for operation on Automatic Farm Lighting Plants.

Service Adjustments
Normal Operation

NORMAL OPERATION

When servicing a Type "DR" refrigerating machine, it is essential that the normal operating characteristics be recognized and taken into account. For this discussion, it will be assumed that the refrigerator is located in a room averaging between 70 to 80 F ambient temperature.

1 *Condenser Temperature:* Except for a minute or so directly after starting, the condenser coils should feel warm to the hand while the machine is running. The warmer the room temperature and the heavier the load on the refrigerator, the warmer the condenser will be. Only under extreme conditions of high room temperature (above 90 F) and heavy load will the condenser get hotter than the hand can stand.

2 *Float Valve Temperature:* The float valve should feel as warm as the middle condenser coils.

3 *Cabinet Air Temperature:* The cabinet air temperature should range between 40 to 48 F. It may go a few degrees higher if the room temperature is above 80 F, warm foods or liquids are placed in the refrigerator or the cabinet door is opened excessively.

Except in the earliest models using the Type "A" control a certain amount of variation in the cabinet air temperature can be obtained with an external adjustment on the control. On machines with oven type evaporators (with a freezing solution), this variation amounts to about 4 degrees; on later machines with open type evaporators (without a freezing solution) it amounts to around 12 degrees Fahrenheit.

4 *Cycles:* The approximate operating periods of standard 60 cycle machines are as follows:

Type of Evaporators	Minutes On	Off
Enameled (Oven)	25	40
Enameled (Open)	5	13
Stainless Steel	4	10

The "on" period will be lengthened and the "off" period shortened under the following conditions:

a The room temperature is warmer than 80 F.
b The cabinet air is made colder than normal.
c Water or desserts are being frozen in the evaporator.
d Foods or liquids (especially if warm) are placed in the cabinet.
e The cabinet door is opened (especially if opened several times or left open for more than a few seconds.)

5 *Power:* The power will decrease several watts from the beginning to the end of a normal cycle, and will be affected by the conditions that influence the cycles. Approximate average watts for 60 cycle machines are as follows:

Machines	Average Watts
DR-1	145
DR-2 oven type evap.	158
DR-2 open type evap.	173
DR-3	200

The average watts for direct current machines operating through a rotary converter are about 50 to 60 per cent higher.

During the "off" cycle the oil conditioner draws from 12 to 15 watts.

6 *Energy Consumption:* The energy consumption of a refrigerating machine is affected by all of the conditions that influence the length of the cycles. Consequently, there will be considerable variation due to location and usage. The following figures will serve as a rough guide to indicate the range that might be expected for standard 60 cycle machines during summer months for reasonable usage in northern states. In southern states, the upper limits may be as much as 25 per cent higher.

Machine	kw.hr./month
DR-1	30-50
DR-2	30-60
DR-3	40-75

The power consumption of direct current machines is about 50 to 60 per cent greater.

7 *Oil Conditioner:* In the base of all Type "DR" machines, except some of the very first models, there is a small heating element to keep the refrigerant from condensing in the oil. It consumes between 12 and 15 watts depending on the line voltage. In room temperatures below normal, it keeps the oil thinner than it would be without a heater and consequently reduces the watts taken by the refrigerating machine motor. The oil conditioner is connected across the line and is on all the time that the connecting cord is plugged into an electrical outlet.

8 *Machine Noise:* Type "DR" machines are reasonably quiet when operating normally. The slight running noise is generally acceptable to most users. It will be noticed that machines with open type evaporators have more of a running tone than older machines with the oven type evaporator.

9 *Vibration During Stopping:* All type "DR" machines pass through a critical speed while slowing down with a resulting slight vibration which may be transmitted to the cabinet. The degree to which this is evident depends on how and where the refrigerator is located. If the refrigerator is properly installed on a relatively rigid floor, this vibration is hardly noticeable.

10 *Control Noise:* There should be no noise from the control except the snap of the contacts and the starting armature during the momentary starting period.

General Service Instructions

1 PROPER POWER SUPPLY

The motor and control of the machine are designed for a definite power supply. The power supplied must be of the proper frequency, and voltage; and Direct Current must never be applied direct to an Alternating Current machine or vice versa. Refer to the section on page 43 explaining Direct Current and Odd Power Supply Application.

Be sure the power supplied to the machine agrees with the rating information on the nameplate.

2 MONITOR TEST INSTRUCTIONS

"Monitor Testing" is the name given to the service operation of adding refrigerant to a hermetically sealed General Electric refrigerating machine.

REASONS FOR MONITOR TESTING: Some of the early machines with "oven" type evaporators (those with freezing solution) were found to become somewhat noisy and low on refrigeration after operating for a couple of years. Investigation showed the reason to be a transfer of oil from the compressor case to the evaporator with a resulting low oil level in the case. This first caused noise complaints, but as the condition became worse with increased usage, brought about low or no refrigeration.

Ordinarily the small quantity of oil going over from the case into the evaporator will be returned, if the liquid level in the evaporator is fairly high and relatively near the suction intake. However, the volume of the "oven" type evaporators was such that the original refrigerant charge maintained a low enough liquid level in the evaporator to allow some oil to collect before any was returned to the case. This amount was enough to cause the low oil condition and the resulting complaints.

Monitor Testing was introduced as a permanent remedy for this low oil condition. By adding a quantity of refrigerant, the evaporator liquid level is raised, returning the oil to the compressor case and preventing its ever collecting in the evaporator again. The compressor is not injured by the low oil condition, being protected by the oil pressure operated unloader.

Generally speaking, the same accumulation of oil cannot occur in the later DR machines with "open" type evaporators, having no freezing solution compartment. However, it may occur occasionally due to a low refrigerant charge.

TEMPORARY REMEDY: The oil collected in the "oven" type evaporator can be forced to return to the case by "heat treating" the machine. By obtaining a violent boiling of the refrigerant in the evaporator with the application of heat, and by bringing the liquid level in the evaporator near the suction tube with tilting the machine forward, the oil is returned to the case. The machine should not be tilted to the front more than 30 degrees from the horizontal and it should be left running in this position between 20 and 30 minutes. The machine should be turned off while heating the evaporator.

This method of correcting the trouble was originally recommended before the introduction of the Monitor Test, but is only temporary as the same transfer of oil will again result in time.

MACHINES TO WHICH MONITOR TESTING IS APPLICABLE: The machines which usually will be found to require the Monitor Test are those with "oven" type evaporators containing a freezing solution.

Later model machines are not subjected to the general troubles which the Monitor Test was designed to correct. However, an occasional DR machine may require the addition of refrigerant in varying amounts due to a loss of refrigerant.

SYMPTOMS: The first symptoms are noises which become increasingly more noticeable, and finally loss of refrigeration. In general the symptoms occur in the following order.

A *Vibrating Burr Noise:* A periodic noise coming and going or rising and falling in regular cycles of time, caused by some refrigerant vapor taken in with the oil.

B *Continuous Pumping Noise:* A continuous pumping noise (continuous vibrating burr) with a metallic sound, and like that observed when a machine is first installed. This is caused by more refrigerant vapor taken in with the oil.

C *Dancing Check Valve Noise:* A light metallic tapping noise caused by the fluttering of the check valve plunger. At this point the base oil level and resulting oil pressure are low enough to cause the unloader valve to flutter. This allows high pressure gas to come up under the check valve plunger at regular intervals and keep it "dancing" or fluttering up and down.

D *Loss of Refrigeration:* This usually starts at the time the "dancing check valve" noise is noticeable and becomes worse as the unloader stays open for longer periods of time. With the unloader open there can be no refrigeration.

On DR-3 size machines with double evaporators, unequal frosting of the evaporators may be noticed.

PRELIMINARY TEST CHECKS: The oil intake pipe extends down into the oil on the left side of the compressor base, looking at the machine from the front. By tilting the machine, the oil intake can be raised farther out of the oil or can be immersed farther into it, with resulting changes in the symptoms.

A The left or *control side of the cabinet top* should be *raised* several inches. If after several minutes the *noise gets worse* or a succeeding symptom develops, it is a sign that the oil level is low and the *machine needs Monitor Testing.* Tilting the machine in this manner raises the oil intake farther out of the oil and hence the noise gets worse or a succeeding symptom develops. A machine with a normal oil supply in the case can have its left side raised 6 or 8 inches before a vibrating burr noise develops.

B The right or *float valve side of the cabinet top* should be *raised* about two inches (not higher, as the evaporator on some models may hit the cabinet wall) and if the *noise disappears* or becomes less noticeable, it is again a sign that the oil level is low and the *machine should be Monitor Tested.* Tilting in this manner tends to immerse the oil intake farther into the oil and greater oil pressure results, doing away with at least part of the noise.

Caution: Before Monitor Testing, be sure that the machine is not noisy because of a defective oil conditioner, or an overcharge of refrigerant. These troubles give some similar symptoms. Refer to the Purging Instructions on Page 57 for the checks that will indicate a machine is overcharged.

AMOUNT OF REFRIGERANT TO BE ADDED: Where refrigerant is being added to supplement the original charge because of oil transfer to the evaporator, one bottle (Cat. No. 11X762) or 1-3/4 pounds should be sufficient for most of the DR-2 size machines with "oven" type evaporator. Occasionally it may be necessary to use two bottles or to add an additional bottle several months after the first treatment with one bottle. Later machines without oven type evaporators will usually only require a half bottle or approximately one pound of sulphur dioxide. Two bottles of refrigerant should be used on DR-3 size machines with serial number below 196,300 and one bottle on ones above that number.

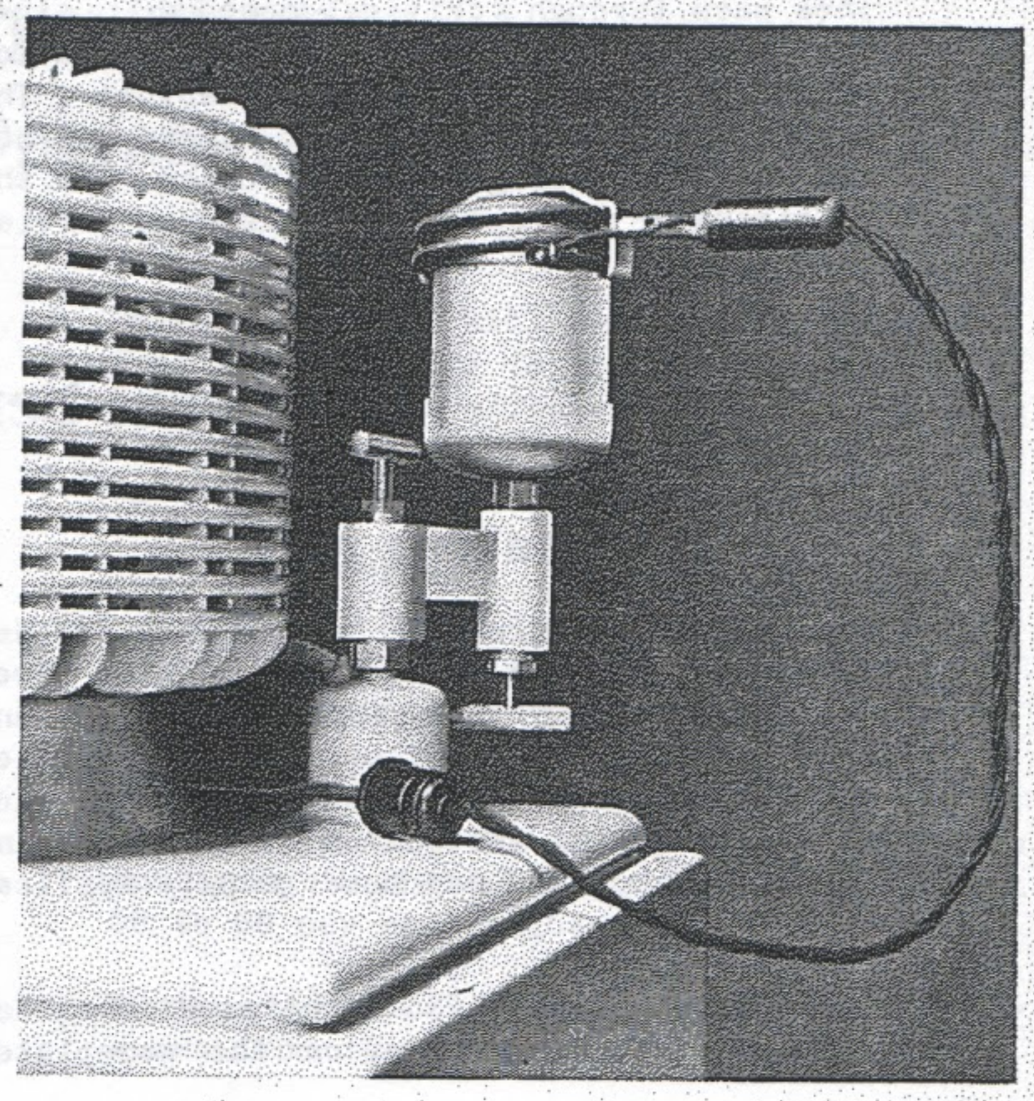


Fig. 133 Monitor Test Set-up

When refrigerant is being added because of an actual loss of refrigerant, the quantity necessary will vary, and a trial amount will have to be added and the operation of the machine checked.

CAUTION: Do not add any refrigerant other than the best grade sulphur dioxide (SO_2) to the machines.

EQUIPMENT

Special equipment has been made up to make Monitor Testing a relatively simple adjustment. The following is included in a Monitor Test Kit, Cat. No. 11X764.

11X765 Adapter
11X766 Heater (500 Watt - 110 volt)
11X767 Wrench for Adapter Gland Nuts
11X122 Purging Wrench
11X768 Lead Gaskets
*11X762 Monitor Test Bottle (1-3/4 lbs. SO_2)
*Concentrated Ammonia
*Oil for Testing Purging Screw

*Not included in Kit.

The Monitor Test equipment should be carefully cared for and always kept in good condition. Do

not allow it to become dirty, or some foreign substance may get into the machine during Monitor Testing. Periodically the adapter gland packing should be checked. Do not use a cold adapter for Monitor Testing as moisture may condense inside the adapter and get into the machine.

PROCEDURE

A *Check the Lead Gaskets:* Only one lead gasket should be used for each connection and they must be in good condition. A lead gasket can be used a number of times if care is taken not to tighten the gland nut or the bottle too tight. Small flakes from the lead gasket can and should be cleaned from the adapter with a knife before it is used again.

In case the gasket is defective it can be cut out with a knife. Care should be taken not to scratch or damage the seats in the adapter.

B *Prepare the Adapter:* Loosen the valve stem gland nuts slightly and pull the valve stems out as far as possible. Be sure the purging screw in the adapter is closed tightly. A little oil should be kept in this purging screw socket at all times to prevent rusting of the threads.

C *Prepare the Machine:* Shut the machine off. The Monitor Test should always be given with the machine shut off. Clean the float valve purging screw socket and loosen the purging screw slightly to break it loose and then reseat it immediately.

D *Assemble the Monitor Tester:*

1 Assemble the bottle to the adapter and tighten the nut.
2 Enter the valve stem into the bottle purging screw and tighten the valve stem gland nut.
3 Assemble the adapter to the float valve of the machine, and tighten the nut.
4 Enter the valve stem into the float valve purging screw and tighten the valve stem gland nut.

E *Purge Adapter and Check for Leaks:* Open the purging screw in the float valve one-half turn and check all joints for leaks with ammonia.

Loosen the purging screw in the adapter body to insure that the float valve screw is open and to purge out the air in adapter. Tighten it immediately.

F *Open the Purging Screws:* Open the float valve purging screw and then the bottle purging screw five complete turns and pull out the valve stems. It may be necessary to exert an upward force on the bottle valve stem while opening the bottle to keep it engaged in the purging screw.

G *Apply Heat to the Bottle:*

Caution: Be sure both purging screws are open before applying heat. Liquid should be heard running into the evaporator.

Plug in the heater and assemble it over the top of the bottle. Keep heat on the bottle until the purging screw socket of the bottle feels warm, indicating that all the SO_2 is in the machine. The length of time will depend on the compressor case temperature and will probably be from five to twelve minutes.

H *Remove the Monitor Tester:* Close the bottle purging screw and then the float valve purging screw. Open the purging screw in the adapter body to relieve the pressure in the adapter.

Note - If liquid comes out it is an indication that the bottle was not heated long enough. If much gas comes out, the purging screws in the float valve and bottle should be opened and reseated.

Remove the adapter from the float valve and disassemble the bottle from the adapter. Tighten the bottle screw with the purging wrench and seal the bottle with its sealing cap to keep air and moisture from getting in.

I *Check the Machine for Leaks:* Tighten the float valve purging screw with the purging wrench and check it for leaks by putting a light oil in the socket. If there is a leak present, open and reseat the purging screw. A small leak may be corrected by using a bottle sealing cap on the float valve purging connection.

J *Check the Operation of the Machine:* Start the machine. If the treatment has been successful, the machine will have a loud pumping noise for a few minutes as the oil is drawn back through the pump. It will then quiet down, and should remain quiet and refrigerate satisfactorily.

If there is no sound of the oil being pumped back when the machine is started, particularly where the complaint has been *no refrigeration*, the float valve end of the cabinet top should be raised about two inches, or as far as the evaporator will allow. By doing this the oil screen will be surrounded by the oil remaining in the base, the unloader will be held up, and the pump will draw oil from the evaporator. If the pump still fails to pull up the oil, another bottle of refrigerant should be put in.

If the loud liquid pumping noise does not abate after an hour or so of operation. it indicates that there is too much refrigerant in the machine. The machine should be purged until it is quiet. Another sign of an overcharge of gas is frosting of the suction tube. The remedy in this instance is to purge the machine heavily. Refer to page 57 for complete Purging Instructions.

If the machine stalls and trips the overload, it should be allowed to stand with the plug connected (i.e. with the oil conditioner heating) for several minutes after which a second attempt should be made to start the machine.

ADDING MORE OR LESS THAN ONE BOTTLE: To add only one-half bottle of refrigerant, apply heat to the bottle for only two minutes. The purging screws should be closed off and the machine checked to see if the operation is successful. If no more refrigerant is necessary, open the float valve purging screw, apply heat to the adapter to drive the refrigerant back into the machine. Then close all valves and remove the adapter.

If two bottles are needed in treating DR-3 size or other machines, run the machine for five minutes after the first bottle has been emptied. After the pressure in the bottle has been relieved, the first bottle may be removed and the second one assembled to the adapter without taking the adapter from the float valve. However, it is better to first close the bottle purging screw and heat the adapter to force the refrigerant in the adapter back into the machine. Then close all valves and remove bottle, after which follow the regular procedure in adding the second bottle.

3 PURGING INSTRUCTIONS

When servicing DR machines it is possible to add too much refrigerant resulting in an overcharged condition, or some machines may be Monitor Tested unnecessarily which will also cause an overcharge of refrigerant. An overcharge can be corrected by "purging" or in other words, letting out some of the refrigerant.

SYMPTOMS OF MACHINE WITH OVERCHARGE: The symptoms of an overcharged machine are practically the same as those for a machine requiring the Monitor Test. Refer to Section above on Monitor Testing. There will be a "vibrating burr" noise, and more of an overcharge will give the continuous pumping noise. Ordinarily, a dancing check valve noise will not result from an overcharge. The refrigeration will also be similarly affected.

It will be remembered that for a machine requiring Monitor Testing, the noise and low refrigeration symptoms were due to low oil in the base and insufficient oil being pumped. In a machine with too much refrigerant, the excess will collect in the base of the compressor with the oil floating on top of the liquid sulphur dioxide which is the heavier. When enough liquid refrigerant collects underneath the oil, instead of just oil being pumped to the bearings, a mixture of oil and refrigerant will be pumped. When the liquid refrigerant strikes the warm bearings, it flashes into gas and thus causes similar low oil pressure conditions existing in a machine that needs the Monitor Test, and hence similar operating symptoms.

PRELIMINARY TEST CHECKS: These can be made in the same manner as when checking a machine to determine whether it should be Monitor Tested. The liquid refrigerant is under the oil in the compressor base and by tilting the machine the oil intake can be moved farther into the refrigerant, or out of the refrigerant and into the oil, with resulting changes in the noise symptoms. It should be remembered that the oil intake is on the left side (looking at the machine from the front).

A The left or *control side of the cabinet top* should be *raised* several inches. If after several minutes the *noise disappears* or becomes less noticeable, it indicates that the *machine is overcharged and should be purged.* Tilting the machine in this manner raises the oil intake out of the liquid refrigerant and into the oil which floats on top of the liquid. Oil alone is then circulated and the machine becomes more quiet.

B The right or *float valve side of the cabinet top* should be *raised* about two inches and if the *noise gets worse* or a succeeding symptom develops, it again indicates that the *machine is overcharged and should be purged.* Tilting in this manner tends to immerse the oil intake farther into the liquid refrigerant so that less oil is pumped and the noise becomes more pronounced.

HOW MUCH TO PURGE: There is no definite method of determining how long to purge a machine or how much refrigerant to remove. Purge out an amount depending on the noise symptoms and then observe the operation of the machine. However, the machine will have to run a considerable time (probably several hours) before the liquid refrigerant is transferred from the base to the evaporator. Hence the machine may not quiet down for this period of time even though sufficient refrigerant has been purged. If, after such a period of time has elapsed, the machine still shows the overcharge symptoms, more refrigerant should be removed.

PROCEDURE: Purging is accomplished by removing the refrigerant through the float valve purging screw.

Caution: When removing sulphur dioxide, care must be taken by the operator not to let very much out into an enclosed room.

A *Purging into Atmosphere:* If a machine is located where the refrigerant gas will do no harm, the purging screw can be opened with a standard purging wrench and the refrigerant allowed to escape into the atmosphere. If very much refrigerant is to be removed, precautions should be taken against the sulphur dioxide getting into the cabinet and cabinet insulation.

B *Purging into Lye-Water Solution:* By running a tube from the float valve, the refrigerant can be discharged directly into a lye-water solution which will absorb the sulphur dioxide, and no odor will be noticed.

A Monitor Test adapter is used to attach a length of copper tubing to the float valve purging screw. Use a 5/8 inch x 1/4 inch flare reduction union in the bottle opening of the adapter and connect about 10 feet of 1/4 inch copper tubing with a 1/4 inch flare nut. If desired a rubber tube can be attached to a short piece of copper tubing.

The lye-water solution should be contained in a wooden or enameled container. One pound of sulphur dioxide will be absorbed by 1-1/4 pounds of lye dissolved in one gallon of water.

Refer to Monitor Test Instructions for information on handling the Monitor Test adapter and assembling it on the float valve. Put the open end of the tubing at the bottom of the lye-water container and open the float valve purging screw five complete turns. Pull the valve stem of the adapter up out of purging screw, and purge until the desired amount of refrigerant has been removed.

Close the purging screw tightly, and quickly remove the purging tube from the solution so that it will not be drawn up the tube. Remove the adapter from the float valve and carefully check the purging screw for a leak, using light oil in the purging screw socket.

Note - If reseating the purging screw does not correct a small leak, use a Cat.No.11X821 bottle sealing cap on the float valve.

C *Purging into Washing Soda-Water Solution:* The equipment and procedure are the same as purging into a lye-water solution except for the solution used. The procedure below allows the removal of exactly 1/2 pound of sulphur dioxide, and by varying the solution other exact amounts can be taken out.

Dissolve one pound of ordinary washing soda (Sal Soda) in two gallons of water, using an enameled container. Assemble the adapter and purging tube as described under part B, placing the end of the purging tube at the bottom of the solution container.

Open the float valve purging screw just enough to allow as rapid flow of sulphur dioxide as possible without its escaping into the atmosphere from the solution. There will be some agitation of the solution at the surface, but there should be practically no odor of sulphur dioxide. After about ten minutes, the solution will become effervescent from the carbon dioxide being released. At this point 1/4 pound of refrigerant has been purged out and the operation is half completed.

Continue purging at the same rate until there is a noticeable odor of sulphur dioxide with the nose about a foot above the surface of the solution. The operation is now complete and 1/2 pound has been removed. Close the purging screw and immediately remove the tube from the solution. Remove the adapter and check for leaks as described under part B.

4 FREEING STUCK FLOAT VALVES

Due to slight corrosion, dirt or mechanical binding, some float valves may stick either in the open or closed position. However, continued satisfactory operation may usually be obtained if the float valve is once freed. Since this valve controls the admission of refrigerant into the evaporator, no or low refrigeration will result if it does not operate properly, and the machine will also tend to be noisy. Below are given the symptoms that will identify a stuck float.

Stuck Closed: When the float valve is stuck closed, no refrigerant will be admitted to the evaporator and hence there will be no refrigeration. After running for a time, all the refrigerant will be pumped from the evaporator into the high side of the system and the machine will run with a heavy pumping noise. The compressor will do very little work and while the machine will run continuously, the watts drawn by the motor will be below normal. The compressor case dome will be warm from motor heat, but the float valve will remain fairly cool. Since the refrigerant has been pumped into the high side, the float valve will be full of liquid refrigerant and if the float valve purging screw is cracked open slightly with a purging wrench, liquid will come out.

Stuck Open: With the float valve stuck in the open position, the refrigerant will merely be circulated through the system and there will be very little refrigeration. The evaporator will probably be cool enough to sweat but not to collect frost, and there will be an audible sound of refrigerant flowing through the float valve. Refrigerant vapor will be purged from the float purging screw. The power drawn by the motor will be higher than normal and the compressor case temperature will be high with a fairly warm float temperature.

Usually a float valve that is found to be giving trouble from sticking will be found in the closed position. Given below are suggested methods of freeing a stuck float valve, all of which apply to stuck closed floats, but some can be used for stuck open float valves.

A *Use a Catalog No. 58X36 Magnetic Float Valve Lifter:* Refer to Use of Magnetic Float Valve Lifter, Page 59.

B *Jarring the Float Valve:* Jar the machine violently by lifting the float valve side of the cabinet top and letting it drop, being careful not to damage the evaporator. Place a Monitor Test bottle cap over the top of the purging screw socket and hammer on it.

Caution: Always use a cap over the threads of the purging screw socket so they will not be damaged. Do not pound on the float valve shell without carefully protecting the finish.

C *Open the Purging Screw Wide:* As explained under the description of the float valve, there is a small spring in the base of the float valve which will raise the float bulb and open the valve if the purging screw is opened sufficiently. This can be accomplished by assembling a Monitor Test adapter to the float valve, with an empty or sealed off bottle on the other side of the adapter. The float purging screw can then be opened eight to ten complete turns, and the only refrigerant that will be lost will be that in the body of the adapter. With the purging screw open this much, the spring will open the float. Allow refrigerant to flush through, with the machine running.

D *Drive liquid from the Float Valve:* With the machine shut off, apply heat to the float valve with the Monitor Test heater until refrigerant gas is purged indicating that all liquid has been driven from the float chamber. Then lift the bulb a few times with the Magnetic Float Valve Lifter to free it, and keep the float open with the Monitor Test equipment as explained above in part C. Let the machine run so as to flush out the float valve. This action can be helped by applying heat to the evaporator while the machine is running.

E *Clearing Plugged Orifice or Liquid Line:* Turn the machine over on its top and apply heat sparingly to the liquid line from the float, using a weak blow torch flame. Gently tap on the liquid line with a wood block.

CAUTION: Do not apply this method to early DR-2 machines with serial numbers below 77,500 if there is any evidence of rusting of the steel liquid tube. Use extreme care not to overheat the liquid line or tap it too hard.

5 INSTRUCTIONS FOR USING MAGNETIC FLOAT VALVE LIFTER

Catalog No. 58X36 covers a Magnetic Lifter that can be used to lift the float bulb in DR float valves.

Complete instructions for use follow:

A Place the lifter on the float valve, the recessed portion of the core fitting tightly over the purging screw socket.

Caution: Be sure that the lifter core goes down as far over the purging screw socket as possible.

B Plug the lifter connecting cord into a suitable electric service outlet, either 110 volt alternating current or 115 volt direct current.

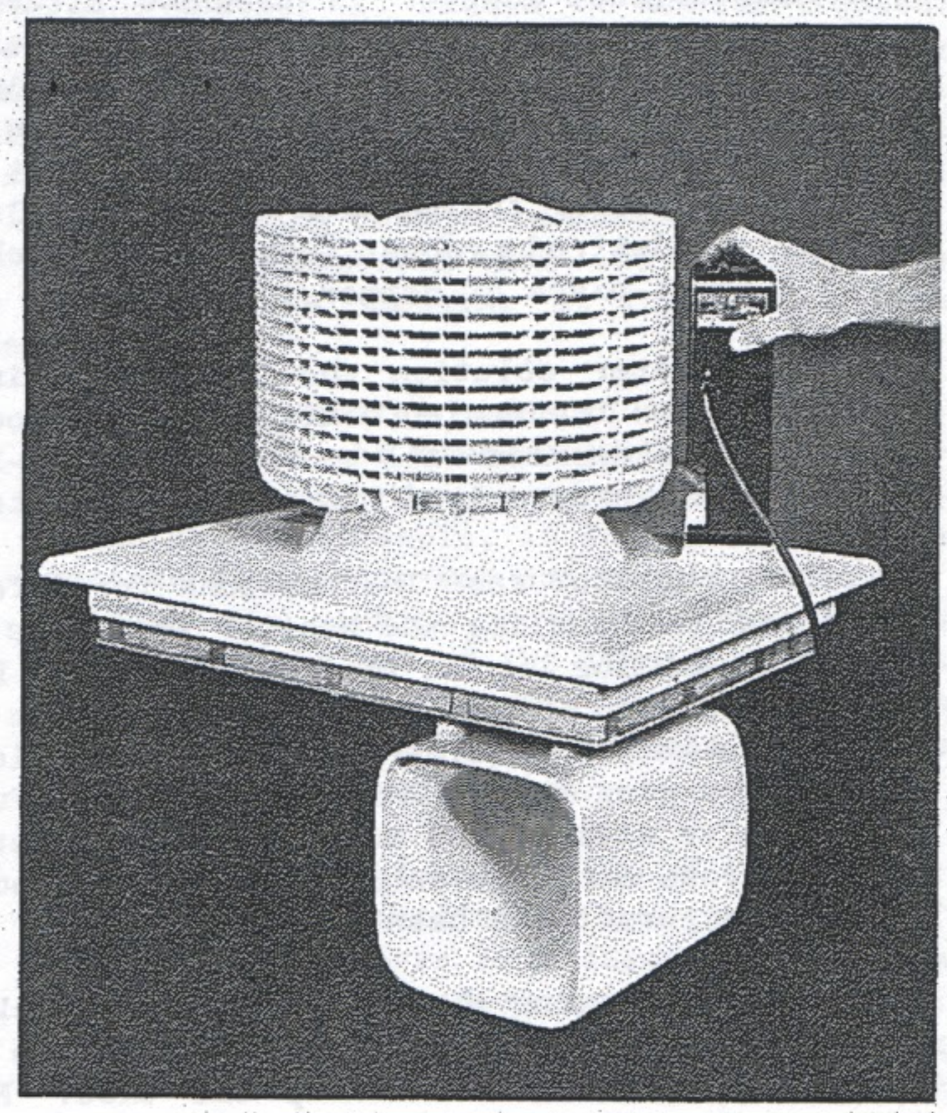


Fig. 134 Float Valve Lifter

C Depress the pushbutton firmly for about one second. When the float bulb lifts, it can be distinctly heard.

Caution: Never hold the pushbutton down for over two seconds; otherwise, the copper oxide rectifier may be injured.

D Repeat four or five times to try to loosen the mechanism, or to limber it up and allow the liquid refrigerant to flush through the orifice, if it has already been loosened.

Caution: Never depress the pushbutton more then eight times in succession without leaving a few minutes for the rectifier to cool.

Checking Copper Oxide Rectifier: If the lifter is used beyond the limits previously mentioned (held on more than two seconds at a time or used more than eight times in rapid succession), there is a possibility that the copper oxide rectifier may be injured.

After checking all connections and the pushbutton, the rectifier can be checked by connecting a direct current ammeter in series with the operating coil:

A Remove one side plate of the lifter by taking out the two small screws.
B Remove one of the operating coil connecting leads from its terminal on the rectifier.
C Attach this connecting lead to one terminal of a direct current ammeter (15 ampere or higher scale).
D Attach an insulated wire lead from the other terminal of the ammeter to the rectifier terminal from which the operating coil connecting lead was removed.

E Place a voltmeter across the two line (center) terminals of the rectifier.

F Plug the lifter connecting cord into a 110-volt A-c outlet.

G With any given voltage across the rectifier, the current should be more than the following minimum values:

Voltage	Minimum Amperes
110	7.8
115	8.1
120	8.5
125	8.8

H If the current is less than the above values, replace the rectifier.

The catalog numbers given below cover replacement parts of the lifter.

Operating Coil 58X37
Copper Oxide Rectifier Unit 58X38
Pushbutton 58X39

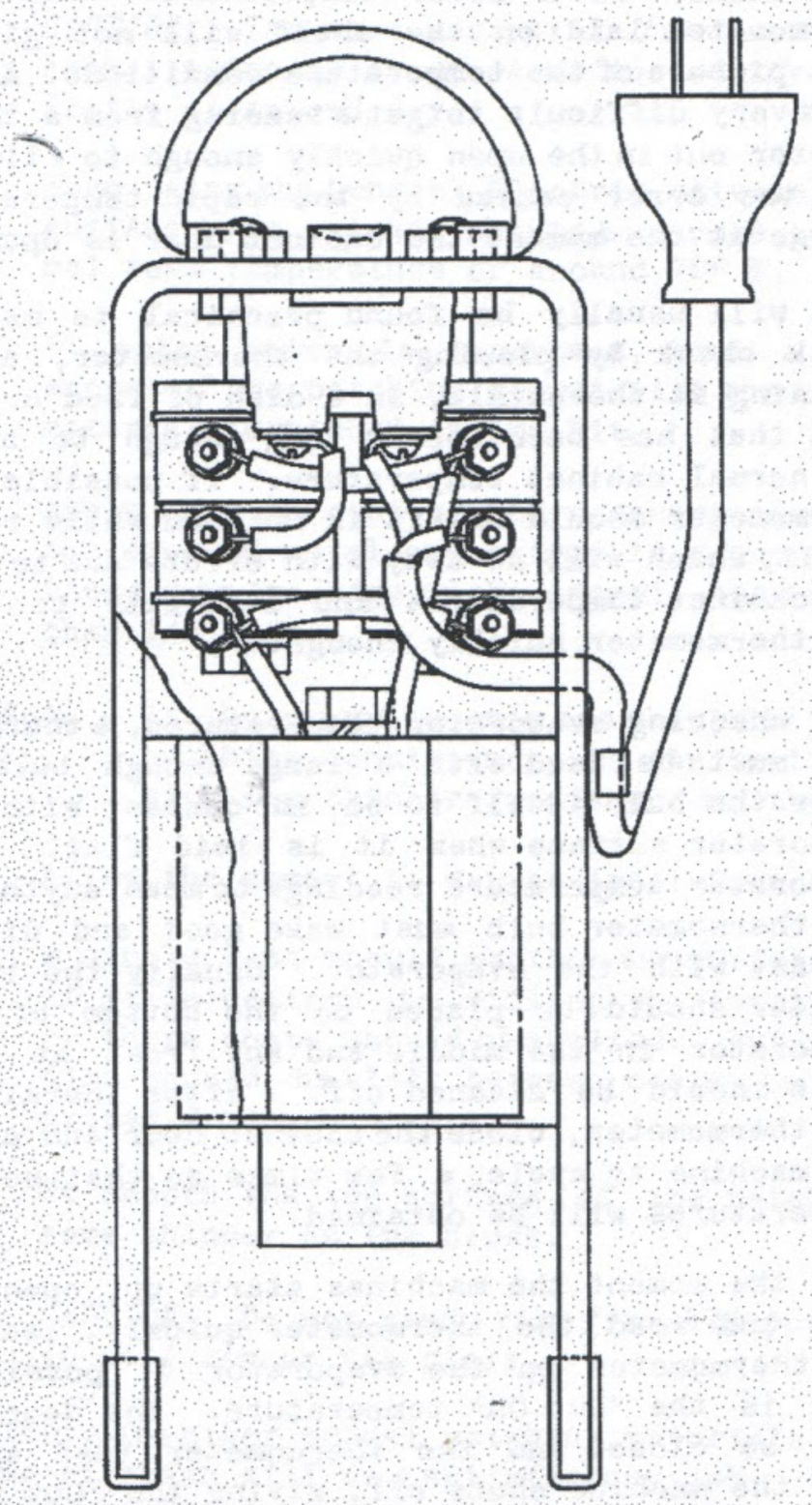


Fig. 135 Wiring Diagram for Float Valve Lifter

Note: Present float valve lifters have the legs cut off so they can be used on Scotch Yoke machine float valves.

Replacing Copper Oxide Rectifier: To replace the copper oxide rectifier remove the two sides of float valve lifter and all wires to the rectifier. The rectifier is held in position by two studs through the top of the lifter frame. Remove the two nuts on the outside of the frame from these studs and this allows the rectifier to be removed. Reverse the above procedure in installing a new rectifier. Refer to Fig. 135 for wiring diagram. The replacement of the operating coil and pushbutton is relatively simple and quite obvious upon removing the sides of the lifter.

6 CHECKING FOR REFRIGERANT LEAKS

A refrigerant leak is usually readily detected since the odor of sulphur dioxide makes itself apparent even when present in small quantities.

To locate a leak, use an uncorked bottle of ammonia or a swab saturated with it. The reaction of sulphur dioxide gas and ammonia fumes produces a white vapor which is easily recognized.

If there should be a very small leak in the low pressure side of the system, it may not be noticeable under certain conditions, such as when the low side pressure is below atmospheric pressure. In this case, air will be drawn into the machine and will collect in the condenser and float valve. Refer to page 63 for Noncondensable Gas.

To locate such a leak, defrost and warm the evaporator by applying heat as explained on page 63. This will cause a high enough pressure in the low pressure side to result in an outward leakage of refrigerant so that it can be detected by ammonia as explained above.

7 CHECKING THE MACHINE DIRECT

When a machine will not start or continually trips off and does not run properly, the trouble may either be inside the compressor case or in some part of the external electrical circuit including the control. If the trouble is internal, there is usually very little that can be done in the field to remedy the difficulty. However, if the trouble is in the control or some other part of the external circuit, repairs or replacements can be made and the machine returned to normal operation.

Oftentimes the location of the trouble is not obvious during the first inspection and an immediate check can be made to determine whether the trouble is internal or external to the sealed compressor case.

Referring to the wiring diagrams, disconnect the three motor leads that come from the cabinet top to terminals on the control or control sub-base. Assuming a 110 volt, 60 cycle machine, connect one side of a 110 volt line to the running winding motor lead and the other side of the line to the

common winding motor lead. Then touch the bare end of the starting winding motor lead against the side of the line connected to the running winding and close the 110 volt circuit. Normally the machine will start up and when it comes up to speed, the starting winding lead should be immediately pulled away from the line. The machine should then continue to run.

Caution: Do not leave the starting winding connected in the circuit more than a few seconds.

It will be noted that this procedure allows the machine to be started with the starting winding in parallel with the running winding, exactly as is the case with the control in the circuit, only the connections are made manually. The circuit external to the compressor case has been completely eliminated and if the machine starts and runs properly, it is an indication that the trouble is external to the case, and should be located and corrected.

Caution: Never run a machine in this manner for any length of time.

8 DEFECTIVE CAPACITOR DR-3 AND 4 SIZES AND 25 CYCLE MACHINES

The DR-3 and 4 sizes and 25 cycle machines have a capacitor transformer mounted on the cabinet top. A defective capacitor will result in the machine not starting. The capacitor itself can best be tested by shorting it out of the starting circuit and seeing whether the machine will run properly.

Caution: Although the machine will start satisfactorily without the capacitor in the circuit, it should never be run for any length of time without a good capacitor properly connected.

The capacitor may be shorted out for checking in the following manner. Put a heavy piece of paper between the upper and lower sets of contacts and the starting arm. In the case of the Type "E" control, both of these contacts are underneath the starting arm. Next, connect a jumper wire from the starting arm itself to the connection to which the overload heater wire is attached. Then try starting the motor and if it starts, the capacitor is defective and must be replaced.

To replace the capacitor, disconnect the capacitor leads from the control panel, attaching a heavy piece of cord to them. Then remove the two screws from each end of the capacitor and take it off, pulling the leads through the cabinet top with the cord attached. Never pull the cord all the way through. Attach the cord to the leads of the new capacitor and pull through the cabinet top to the control panel. Connect the wires as shown in the wiring diagrams.

In case the capacitor leads do not pull through the cabinet top easily, they may be cut at the capacitor and the new capacitor connected at this point. Remember to connect wires of one color together and also to make a tight, lasting connection. Solder any electrical connections that have to be made and properly insulate them.

9 CHECKING CABINET AND EVAPORATOR TEMPERATURES

Many wrong conclusions and improper service can be caused by improperly checking the temperatures within the refrigerator.

A thermometer laid on a shelf to measure cabinet temperature is not very satisfactory for several reasons. When a refrigerator is being inspected, the door is usually opened a few times and there is no way of knowing how much the customer has opened the door previous to the inspection. Naturally, with door openings, the actual cabinet air temperature is going to be somewhat high, but the food temperatures will not fluctuate so much and will remain at a lower temperature. Hence, a thermometer laid on the shelf will not give a true picture of the temperature conditions. Also, it is very difficult to get a reading from a thermometer out in the open quickly enough to eliminate the error caused by the rapid temperature change at the moment the cabinet door is opened.

It will usually be found practical to make a quick check by placing the thermometer, after cleaning it thoroughly, in a dish of food or liquid that has been stored long enough to be at the normal cabinet temperature. If possible the thermometer should be left in the food while reading it, which will do away with errors due to rising cabinet temperatures and inability to read the thermometer quickly enough.

In checking evaporator temperatures, a thermometer must be used with a large enough bulb to allow the bulb itself to be in contact with the evaporator surface when it is laid flat. For evaporator temperature readings to mean anything, the thermometer bulb must make good and direct contact with the evaporator. Usually the thermometer should be placed on the bottom of the evaporator in the middle and any frost at that point should be cleaned off. After installing the thermometer, close the cabinet door and allow the machine to cycle a few times so that normal temperatures will be obtained.

At the moment the machines starts up, open the door and read the thermometer quickly, leaving the thermometer on the evaporator if possible. This is the "Cut On" temperature. The door can then be closed and the thermometer read again when the machine shuts off, giving the "Cut Off" temperature.

In general the "Cut On" temperature is more accurate and it is this temperature that should be given the most consideration in making any analysis of the machine and control operation.

10 PATCHING PORCELAIN EVAPORATORS

Many tests have indicated that porcelain enamel patching is a practical field operation and if properly applied will protect the surface for a number of years.

Under Cat. No. 58X85 the General Electric Company furnishes a Porcelain Patching Kit which will give satisfactory results. Below is given the procedure for applying the General Electric Material.

A Sand the chipped surface thoroughly with a medium emery cloth such as grade 280A. Make absolutely sure that all loose enamel around the chipped area is removed and that all traces of rust are cleaned off.

B Clean the exposed metal and the enamel around the chipped spot with the cleaning fluid in the patching kit. Carbona, thinner or Acetone can also be used.

CAUTION: The main essential for successful enamel patching is to have the surface perfectly clean and dry.

C When using the General Electric material, the surface to be patched should be warmed to normal room temperature or around 70° F.

D If color match is important, tint a small amount of the patching cement with the tinting material furnished in the kit.

E Apply an even coat of the patching cement to the exposed metal and extend it a short distance over the edge of the enamel, but not more than 1/4 inch.

Note – If the cement becomes too thick for proper brushing consistency, it can be thinned with the thinner furnished in the kit.

F Allow the cement to dry at least four hours.

G A single coat should protect the surface, but if it is desired to fill up the cavity, two or three coats should be applied. Sufficient time should be left between coats to allow proper drying.

H To smooth the top surface of the patch, use some thinner on the brush.

CAUTION: Do not sand the finished patch as it will remove the gloss.

There are other enamel patching materials sold, some of which will do a satisfactory job. "Bulldog Quality" white patching stick, made by the Universal Shellac Stick Company of New York is one of these that is recommended. This material gives good protection, holds its color well, and is easier to apply in the customer's home. When applying this material it is not necessary to warm the surface to room temperature, but it is still essential that it be perfectly clean and dry. To apply, use a soldering iron, fill the cavity, and carefully smooth the surface. Work the material down on the metal so that all air bubbles are removed.

11 REPAIRING CORRODED EVAPORATOR TUBES

On machines that have been in service for some time corrosion may take place on the tubes entering the evaporator header. This condition can be satisfactorily taken care of in the following manner.

A Clean thoroughly the tube and joint of all paint and corrosion, and allow it to become perfectly dry.

B Wrap the tube and joint with a special Rayon tape covered by Cat. No. 11X682.

C Paint the wrapped tube with Acetone, obtainable at any drug store.

D Allow this to completely dry and set and then cover it all with a good grade of aluminum paint or white lacquer.

12 REMOVING STRIPPED PURGING SCREWS

Sometimes the float valve purging screw splines become stripped so that it cannot be opened with the purging wrench even though the machine is fully charged with sulphur dioxide, it is possible to remove the stripped purging screw and replace it.

Drill out the purging screw, using as large a drill as possible without cutting the threads (15/64 inch maximum). The heat of drilling tends to loosen the threads so that usually the remaining part can be removed with a suitable Easy-out.

Do not drill completely through the purging screw and clean off all metal chips before removing the screw to prevent chips from getting in the float chamber where they would cause trouble.

Caution: This operation should be done in the open where the presence of sulphur dioxide will not be objectionable.

After the screw is removed, quickly replace it with a new one, Cat. No. 58X175, and tighten it so that as little as possible of the refrigerant is lost.

Caution: The operator must be particularly careful to protect his hands and face from liquid refrigerant. It is best to use a gas mask.

There will not be a great deal of refrigerant lost if the replacement is made quickly. When necessary, some can be added.

13 APPLYING HEAT TO THE MACHINE

In several of the recommended adjustments, it is suggested that heat be applied to the machine. In general this means putting some source of heat in the evaporator. This increases the pressure of the refrigerant in the evaporator and if the machine is running, the load on the machine will be increased so that the case dome and condenser will be quite hot. The machine should be turned off while heating the evaporator.

If Monitor Test equipment is available, the Monitor Test heater can be placed in the evaporator.

CAUTION: Never allow the coil of the heater to rest directly on the evaporator surface.

Trays or pans of hot water can also be used in the evaporator or any other similar heat source. However, the following caution should always be observed when applying heat to a machine.

CAUTION: Never allow the dome of the compressor case or evaporator to become hotter than the hand can stand. Never leave a heater in the evaporator for any extended period of time.

14 CHECKING FOR ODORS

Experience has proven that most odor complaints can be traced directly to the foods that are or have been stored, improper cleaning or improper storage of the foods. There are very few items used in the construction of a General Electric refrigerator which will give off odors and these are carefully tested and checked before being actually used. Therefore, the usage of the refrigerator should be carefully studied on all odor complaints.

There are certain foods, having strong characteristic odors that should not be stored inside the cabinet and all foods with an odor or capable of absorbing odors should be covered or wrapped before placing them in the refrigerator. The cabinet must be periodically cleaned.

If, for some reason, the cabinet insulation has become wet, this may cause odor complaints. Also, if the cabinet has been near sulphur dioxide such as in the case of the refrigerant leak in the machine, some of it may have been absorbed by the insulation, and would cause odors. To correct this, and also wet insulation, remove the insulation from the cabinet, and dry and air it until all odor has disappeared.

Make sure that the No-oxide cloth seal in the throat of the cabinet is in good condition, so that the insulation is sealed.

Machine Service

1 REQUIRES MONITOR TESTING

See Monitor Test Instructions on page 54 under the Section on General Service Instructions.

2 OVERCHARGE OF REFRIGERANT

See Purging Instructions on page 57 under the Section on General Service Instructions.

3 FLOAT VALVE STUCK CLOSED

See instructions for Freeing Stuck Float Valves on page 58 under the Section on General Service Instructions.

4 FLOAT VALVE STUCK OPEN

See instructions for Freeing Stuck Float Valves on page 58 under the Section on General Service Instructions.

5 NONCONDENSABLE GAS

If noncondensable gas (air) gets into the system it will collect in the float valve chamber and restrict the float operation. This is not a common trouble on Type DR machines.

The noncondensable gas collecting in the float valve will make the temperature of the float housing cooler than the condenser coils.

The usual complaint will be for noise since the higher pressures result in liquid condensing in the base. The liquid refrigerant, circulating with the oil causes a "vibrating burr" or "pumping" noise. Unless there is a large amount of noncondensable gas in the system, the refrigeration will probably not be affected very much.

If the purging screw is just cracked open, noncondensable gas will be bled. This is the proper method of correcting the trouble.

It is best to put a little light oil in the purging screw socket and then just crack the float valve purging screw, not more than 1/12 or 1/16 of a turn, and allow the noncondensable gas to bubble up through the oil. The rate should not be so fast that the oil is blown out of the purging screw socket. This slow bleeding should be continued until the float valve warms up to the same temperature as the upper condenser coils.

CAUTION: It is essential that the purging or "bleeding" be done slowly so that there will not be excessive odor from the sulphur dioxide and so that the noncondensable gas will be completely removed.

6 STUCK CHECK VALVE

Once in a while the check valve may stick in either the open or closed position. Below are given symptoms.

A *Stuck Closed:* If the check valve is stuck closed there will be no refrigeration as the suction line will be closed off. The machine will run continuously with the dome warm because of motor heat, and the condenser and float valve will be about room temperature as no refrigerant is being compressed. There will be no boiling in the evaporator and the check valve cannot be heard seating when the machine stops.

B *Stuck Open:* With the check valve stuck open the machine will operate normally during the "ON" cycle. However, as the machine stops, refrigerant from the case will leak back into the evaporator warming it up and causing partial defrosting. The check valve cannot be heard seating when the machine shuts off and there will be a hissing noise evident inside the compressor case from the refrigerant leaking back to the evaporator. The suction line will warm up after the machine has shut off and the refrigerant from the case will also warm up the evaporator enough so that the control will turn the machine "ON" in a relatively short time. This means that although the top of the evaporator may be warm, due to the leak back of refrigerant, the rest of the evaporator will be maintained at a fairly low temperature, and this will result in low cabinet temperature under some conditions. Also, since the machine has not properly unloaded, the overload may trip when the machine starts up again.

It may be possible to correct a stuck check valve by a severe jarring or by applying heat to the evaporator as described on page 63. The build-up in pressure may break the check valve loose.

7 STUCK UNLOADER

Although very little trouble is experienced with the unloader itself, occasionally very slight corrosion or some other factor may cause it to stick. The following symptoms will be noted:

A *Stuck Closed:* While the machine is running the operation will be normal, but it will be impossible to hear the check valve seat when the machine stops. There will be no hissing sound evident since the closed unloader will keep any refrigerant from entering the check valve chamber or suction line. The machine will not unload and therefore there will probably be excess vibration on stopping. The overload may trip on starting due to the excess load.

B *Stuck Open:* With the unloader open during the running cycle, the compressed refrigerant is short circuited through the unloader tube and back into the cylinder. No refrigeration will take place and the machine will run continuously with a hissing noise in the case. The dome of the compressor case will tend to be quite warm from the continuous running of the motor, but the float and condenser coils will be around room temperature.

A stuck unloader may be broken by a severe jarring of the machine. If it is stuck open, jar the machine while it is upside down, but do not run the machine in this position.

8 DISCHARGE VALVE LEAKAGE

A leaky discharge valve will result in high pressure refrigerant being sucked from the case into the cylinder on the intake stroke. No or low refrigeration will result and hence the machine will run a high percentage of the time. The compressor case dome will be hot from the motor heat, with the condenser and float valve around room temperature.

Depending on how bad the discharge valve is leaking, the above symptoms will vary, with the worst conditions resulting from a bad leak.

If the leak is being caused by a small chip or some such object under the valve, it is possible to correct the condition by applying heat to the evaporator as described on page 63. The high pressure built up from the heat will tend to flush out the discharge valve.

9 DEFECTIVE OIL CONDITIONER

A defective oil conditioner will show up particularly in cool room temperatures because of the "vibrating burr" or continuous pumping noise that results. Refrigerant will condense in the compressor base and the liquid refrigerant is circulated through the moving parts along with the oil causing the noise.

The oil conditioner is connected directly across the line and is drawing a small current whenever the connecting cord is plugged in. Therefore, with the machine turned "OFF", a series test lamp in one side of the line to the refrigerator can be used to check it. The lamp will glow dimly if the oil conditioner is working properly; a bright glow indicating a short circuit, and no light indicating an open circuit.

To replace the oil conditioner disconnect the machine from the electrical outlet, remove the machine nameplate from the front skirt of machine and, when present, take out the rubber plug that fills the opening underneath the nameplate. A small wire hook can then be inserted through the opening and the oil conditioner leads and the small heater

itself pulled out. Cut the leads about six inches above the heater and solder on a new oil conditioner. Make sure that the leads are properly insulated.

Then insert the heater in the small tube which is inside the cabinet top and underneath the base of compressor case. Care must be taken to see that the oil conditioner is in this tube and not placed in the cabinet top insulation. Replace the rubber plug and the nameplate.

Note - A few of the early production machines did not have oil conditioners, but in general most of this type of machine will be found to have them.

10 COMPRESSOR STUCK

Occasionally a compressor becomes stuck due to slight internal corrosion or mechanical binding. When the motor is turned on, the starting contacts of the control will close and a humming noise will be heard, but the motor will not turn over. The overload protective device should trip out in a very short time.

CAUTION: If the overload does not trip when it is obvious that the motor is stalled, do not leave the motor "on" over 30 seconds. Disconnect the machine from the electrical supply and properly adjust the overload.

Make sure that the reason for the stalled condition is internal by checking the machine direct as indicated on page 60. Many times a machine stalls because of a stuck compressor and will operate satisfactorily after being broken loose. A heavy jarring of the machine may be sufficient, or the momentary application of 220 volts to the motor. Use an auto-transformer to obtain 220 volts if 220 volt service is not available.

CAUTION: Do not leave 220 volts on a 110 volt motor for more than a second or so, as the stator windings will be damaged. It is the initial torque from the 220 volts that will free the compressor.

11 BURNED MOTOR - DEFECTIVE COPPER BAR ROTOR

If the motor is burned, the machine will not start and the dome of the compressor will be brown indicating overheating of the lacquer. A burned oil odor can also be noticed if the float valve purging screw is opened slightly. Care should be taken to make sure that a burned motor is the trouble, but if this fact is definitely determined, nothing can be done in the field to correct it.

Burned motors on early DR machines are usually due to increased copper bar rotor impedance, frequently caused by a reoccurrance of low voltage conditions. Tripping off complaints will usually precede this condition, before the motor burns,

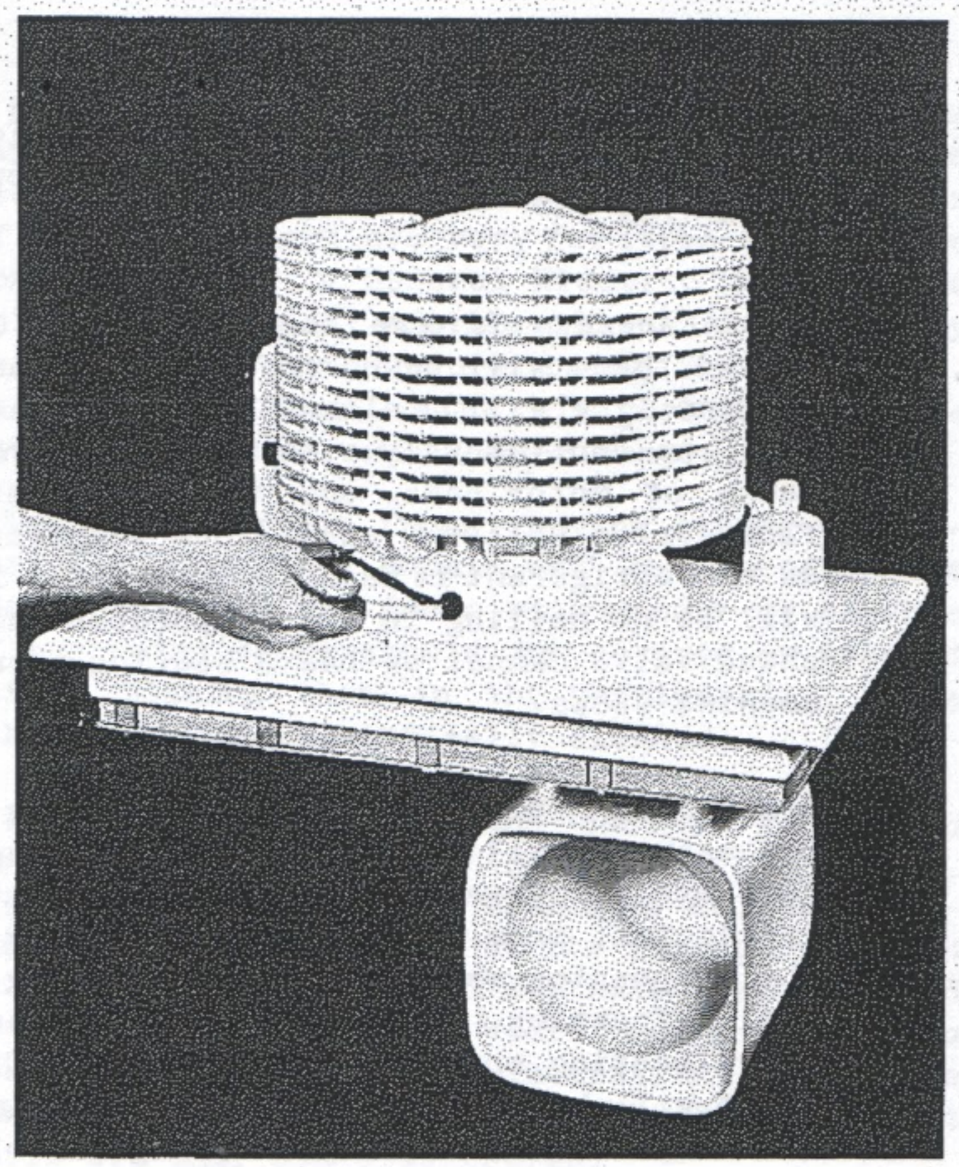


Fig.136 Replacing Oil Conditioner

when the rotor stops in a position where the effect of the increased impedance is most serious.

Later machines have a cast aluminum rotor and this condition cannot happen. Therefore, a burned motor in these later machines is due to some other cause.

CAUTION: Never adjust the overload device beyond the limits given in the Control Section to keep the machine from tripping. If the machine is not properly protected, burning of the motor may result.

12 HARD RUNNING MACHINE

Although it is very infrequent, an occasional machine may be found that trips the overload protective device and inspection shows that no other trouble is present. Due to mechanical binding or some other internal cause, the compressor may be stiff, resulting in a heavy load on the motor. The watts input to the motor will be higher than normal and the tripping out is caused by the excess current drawn by the motor. Because of hard starting the inside of the control cover will usually show evidence of overheating of the resistor.

Nothing can be done to correct this condition, but make certain that the trouble is not caused by some defect in the external circuit to the motor or in the control.

13 OPEN CIRCUIT

If the machine will not run or start, there may be an open circuit in the line to the refrigerator, in the external circuit or control, or possibly in the machine itself. Make sure that the house fuses have not blown and that power is being supplied to the refrigerator. It should then be determined whether the trouble is inside the machine or external and this can be done as explained on Page 60 under Checking the Machine Direct.

If the circuit is open inside the case, it cannot be corrected in the field, but any external trouble can be found and remedied.

A series test lamp is the best aid when locating an open circuit and should be used. All wiring connections should be carefully inspected and each line to the motor checked with the test lamp. An open circuit may be present in the starting resistor of the control or in the capacitor on DR-3 and 4 sizes and 25 cycle machines. Refer to Page 61 for information on checking these items.

An open circuit in the running winding of the machine is indicated by the failure of the main control contacts to spark when opened and closed. An open circuited starting winding is indicated if the starting contacts do not spark when opened and closed manually.

14 GROUNDED CIRCUIT

A grounded circuit may cause failure to start, tripping off, or possibly high power consumption. Blowing of the house fuses may result or a lead wire might be burned off.

If the circuit is grounded outside of the compressor case, it can be located and corrected. If the ground is inside the case, there is nothing that can be done.

To locate a ground, a series test lamp is necessary and when making any checks be sure that the machine or cabinet is not externally grounded as the line may be short circuited to ground.

With the connecting cord plugged in, and the main switch turned to "ON", insert a series test lamp between one side of the line to the refrigerator and a spot on the case where the finish has been rubbed off. If the lamp lights, there is a ground somewhere in the refrigerator.

To check the machine itself, disconnect the motor leads from the control, and connect one of the leads direct to one side of a 110 volt circuit. Then insert the series test lamp between the other side of the 110 volt line and a bare spot on the machine. If the lamp lights, there is a ground either inside the case or in the cabinet top. If excessive moisture has gotten into the cabinet top, this may cause a grounded circuit.

The control, connecting cord, and all connections should be carefully checked for moisture, dirt and evidence of arcing. The control can be checked separately with a series test lamp. The sub-base of the Type "D" and "E" controls should be examined carefully for evidence of a ground.

Note – A partial ground may not interfere with the operation of the machine, but may, under certain conditions, cause a slight electrical shock to a person touching the refrigerator. Wet insulation in the cabinet top may cause such a condition and this should be checked.

15 SHORT CIRCUIT

A short circuit will usually cause blowing of the house fuses, or tripping of the overload, and can ordinarily be found on inspection by evidences of moisture or arcing between two electrical leads. All wires and connections should be carefully checked and if no external short is found, it is possible that the trouble is inside the case, where it cannot be corrected.

Under some conditions, a short circuit may cause the machine to draw excessive power, or the machine may not start.

16 LOSS OF FREEZING SOLUTION – OVEN TYPE EVAPORATORS

All machines with "oven" type evaporators, have a freezing solution between the two outer shells of the evaporator. Three solutions were used; 20% glycerine, Sun oil, and potassium carbonate.

If the solution leaks out, the frost line will drop and refrigeration will be affected. Regardless of the type of solution in the machine, it should be replaced with a 20% glycerine solution after the outer chamber of the evaporator has been drained. After replacing the solution, be sure that the plug in the evaporator is securely sealed with lacquer.

Note – For DR-2 size machines, approximately five pints of the glycerine solution is correct, using one pint of glycerine to four pints of water. For machines with larger evaporators refer to the specifications on pages 11 to 13 for the amounts.

17 SLIGHTLY LOW REFRIGERANT CHARGE – STAINLESS STEEL EVAPORATORS

The DR and D machines that were built with stainless steel evaporators are very sensitive to the refrigerant charge. If the charge is just a few ounces low, freezing cabinet temperatures may result, and if the control is set to get a warmer temperature, a slight defrosting of the evaporator header may be noticed. A very few ounces (3 or 4) of refrigerant should be added to these machines, from a Monitor Test Bottle. Refer to Monitor Test Instructions page 54. Be careful

not to add too much.

18 VIBRATING BURR

In an occasional machine, there may be a "vibrating burr" noise, particularly in low room temperatures. The noise is like the first symptom of a machine requiring Monitor Testing, or with a defective oil conditioner, but in this case is caused by neither and cannot be corrected.

19 NOISE AFTER FIRST STARTING

After having been shut down (connecting cord disconnected) for a period of time, the units will tend to be somewhat noisy when first started. During the shutdown, a certain amount of refrigerant condenses in the compressor base, and upon starting, this liquid refrigerant is circulated along with the oil, resulting in a noisy condition. This does not indicate that anything is wrong, and the machine will quiet down to a normal level, although this may take a little time, especially if the room temperature is cool.

This noise at starting may be eliminated by plugging the connecting cord into the outlet several hours before the machine is started. This allows the oil conditioner to heat the oil and drive off the liquid refrigerant.

20 EVAPORATOR BOILING NOISE

A boiling noise in the evaporator is a normal characteristic of the machine. Ordinarily it cannot be heard with the cabinet door closed. The boiling noise may also continue for some time after the machine has shut off without indicating anything wrong.

21 MECHANICAL RATTLE OR POUNDING

An excessively bad mechanical noise inside the compressor case may be caused by a broken or loose part. This cannot be corrected in the field. A continuous pumping noise is sometimes mistaken for a mechanical pounding noise.

22 RADIO INTERFERENCE

Due to the type of motor used there is no radio interference during the normal running of the machine. When the control trips on there may be a click from the radio, such as is noticed when any electrical switch is turned on. If radio interference is actually traced to the refrigerator, there may be a ground or short circuit.

Control Service

1 CONTROL SET TOO WARM

The original control temperature limits were selected to maintain evaporator temperatures that would provide satisfactory cabinet temperatures and ice freezing in normal room temperatures. If the setting is made much warmer, the cabinet temperature will be raised and the ice freezing time increased. Also, if the setting is made such that the "Cut On" point of the evaporator is above freezing (32 F), a slight defrosting of the evaporator will result during the "Off" cycle.

Cabinet temperatures should be maintained between 40 and 48 F, and this is a simple check on the control setting. Another check can be made by measuring the evaporator temperature limits. The proper temperatures are given in the Specifications.

The Type C, D and E controls have an external temperature adjustment that the user can change and all the controls have an additional internal adjustment that can be obtained when necessary. See page 26 of the Control Section for Temperature Adjustment Instructions.

2 CONTROL SET TOO COLD

Too cold a control setting has the opposite effect on evaporator and cabinet temperatures as when set too warm. Freezing cabinet temperatures may result, especially if the room temperature is fairly cool, and the machine will have to run a greater percentage of the time.

The evaporator and cabinet temperatures should be checked. If the external temperature adjustment on Type C, D and E controls is not sufficient to obtain proper temperatures, additional internal adjustment can be made on all controls as explained on page 26 of the Control Section.

3 IMPROPER CONTROL TEMPERATURE DIFFERENTIAL

The differential between the "Cut On" and "Cut Off" temperatures of the control is definitely set in all the controls and does not change when either an internal or external temperature adjustment is made. However, if the "Cut On" temperature is too high, such that it is above 32 F, defrosting will result during the "Off" cycle. Ordinarily, if the "Cut On" temperature is too high, lowering the control setting as explained on page 26 will correct the trouble. If this is not sufficient the "Cut On" temperature alone can be lowered by means of an internal adjustment. Instructions for making this adjustment on all the controls are given on page 26 of the Control Section.

4 WEAK BELLOWS

As explained under Control Operation, the bellows is charged with sulphur dioxide and pressure exerted by the bellows works against a definite spring pressure. If the bellows becomes weak or loses its charge completely, the spring pressure will be too great and the control will not operate properly.

A weak bellows means that the evaporator will be maintained at a higher temperature in order to build up enough pressure in the bellows to overcome the main spring tension or compression, as the case may be. Consequently, there will be low refrigeration and the cabinet air temperature will be high. If the bellows is very weak or completely "flat", there will not be sufficient pressure built up in the bellows to operate the control at all and the main contacts will not be closed. In this case the complaint will be that the machine will not run.

To check the bellows, warm the end of the bellows tube which is clamped to the evaporator. A good bellows should expand, but if it does not, and can be easily compressed with the fingers, it has lost its charge and should be replaced.

Refer to page 28 of the Control Section for instructions on replacing the bellows.

5 BELLOWS TUBE NOT MAKING GOOD CONTACT WITH THE EVAPORATOR

It is essential that the end of the bellows tube be in good contact with the evaporator since temperature control of the refrigerator depends upon the variation of pressure within the bellows due to evaporator temperature changes.

The usual complaint, if good contact is not maintained, will be too low a cabinet temperature. This is true because the evaporator will pull down to a lower than normal temperature before the same pressure change takes place in the bellows that would ordinarily happen if the bellows tube were in close contact with the evaporator. A low evaporator temperature means low cabinet temperatures.

Note - The evaporator temperature at which the machine turns "On" will not be raised materially by poor bellows tube contact, since the cabinet temperature itself will be high enough to increase the pressure in the bellows to the point where the control will operate and turn the machine "On". Therefore, the overall effect of poor bellows tube contact is to lower the "Cut Off" temperature enough to cause low cabinet temperatures.

The evaporators on which it may be difficult to obtain good bellows tube contact are the porcelain "open" types. *It may be found that the threads of the clamp are stripped and the clamp cannot be tightened sufficiently to make a good tight contact. Where this happens, an expansion bolt Cat. No. H18X25 can be used.*

6 WEAK TEMPERATURE SPRING

If the main temperature spring becomes weak, the bellows pressure will not have to be as great to cause the control to operate. Therefore the evaporator will be held at lower operating temperatures and low cabinet temperatures will result. If the temperature adjustments of the control are checked and found to be normal and the evaporator is still too cold, replace the temperature spring and observe its operation.

7 WEAK BRIDLE SPRING TYPE C, D AND E CONTROLS

The bridle spring (See Pictures) in the Type C, D, and E controls acts to snap the bridle when the bellows arm is in a position where the main contacts should be opened or closed. As the bridle itself is snapped, this opens or closes the main contacts with a snap action that is necessary to reduce arcing and burning of the contacts.

The bridle springs originally used were phosphor bronze and after a long period of usage, they may become weak. This means that the contacts will not be properly closed and an arc is drawn which may flow a little metal and cause a high resistance point of contact, with resulting tripping out complaints or the contacts may be welded together slightly and cause continuous running of the machine.

The bridle spring may become so weak that it will not snap the main contacts open or closed as the case may be when the control has reached the point where it should turn the motor "Off" or "On". This means that in some cases the machine will continue to run causing a very low cabinet temperature, and at other times it will not start.

The contacts should be cleaned up and the bridle and latch springs replaced.

CAUTION: Whenever a bridle spring is replaced, the latch spring (Refer to Pictures) must be replaced at the same time. The latch spring acts to push the latch arm up and open the main contacts when the overload trips. If a new latch spring is not installed along with the stronger bridle spring, the machine will not be properly protected by the overload under certain conditions.

The new and stronger bridle and latch springs are made of steel and are cadmium plated. The catalog numbers of the springs are as follows:

Type "C" Control - Cat. No. 58X84 (Set of bridle and latch springs)

Type "D" and "E" Controls-Cat. No. 58X28 (Set of bridle and latch springs)

After replacing bridle and latch springs, it is recommended that the gap between the main contacts be checked so that the proper control differential will be maintained. Refer to page 26 of the Control Adjustments.

8 IMPROPER LATCH ACTION TYPE "A" CONTROLS

In the Type "A" Control the main contacts are operated through a latch mechanism which acts to open and close the contacts with a snap action. If this mechanism is not in adjustment, the contacts will open and close slowly, causing arcing and burning which may eventually result in tripping off complaints. The contacts may not open as far as they should with the result that the control will turn the machine on again in a short time. If the latch mechanism does not snap the contacts open at the proper time, the machine may run long enough to give low cabinet temperatures, and if the contacts stay open beyond the proper time, the evaporator may warm up and defrost slightly during the "Off" cycle.

The latch mechanism in these Type "A" Controls should be carefully checked to see that snap action is being obtained and that the contacts are being fully opened. If the contacts are dirty and burned, clean them as explained on page 70.

If the temperature differential adjusting spring (Refer to picture on page 30) is not under compression, the contact arm will not be held firmly in position and the latch mechanism will not operate properly.

CAUTION: The knurled temperature differential adjusting nut must not be set less than 1/4 inch from the end of the screw, if the temperature differential spring is to be under compression and the latch operate properly. Always check this.

It may be found that the inner latch arm is bent. A long-nosed pair of pliers can be used to adjust this arm to obtain proper operation. Also, the small leaf spring attached to the main arm of the latch mechanism may be loose or bent out of shape.

9 DEFECTIVE RESISTOR

The resistor is in series with the starting winding and it is possible that an open circuit might develop in the resistor so that the machine would not start. Replace the resistor and see if the trouble is eliminated.

Some of the machines used copper oxide resistors (Refer to the Control Section) in the controls and the great majority of tripping out complaints on these machines can be traced to defective copper oxide resistors. Copper oxide has a negative coefficient of resistance; that is, its resistance decreases the warmer it gets. The purpose was to reduce the initial surge of starting current by having a relatively high initial resistance which decreased rapidly as the resistor warmed up. However, with continued usage it was found that sometimes the resistance increased and eventually caused tripping of the overload.

When complaints are received, always replace the copper oxide resistor with a wire wound resistor.

10 LOW VOLTAGE

No trouble should be experienced if the voltage remains above 100 volts. The machine and starting relay are designed to operate satisfactorily between 100 and 125 volts. If the voltage is slightly lower than this the overload may trip because of failure of the machine to start under certain conditions.

A machine should not be installed where the voltage goes below 90 volts periodically or for any extended period of time.

CAUTION: It is essential that the overload device be properly set, and it should never be adjusted so that it will not trip, when the cause is actually low voltage, or serious damage may result.

When checking the voltage being applied to a machine, always connect the voltmeter across the line at the terminals of the machine. Many times there is an excessive voltage drop in the house wiring and this must be taken into consideration. It is the voltage *at the machine* that determines its operation.

11 HIGH VOLTAGE

The relay part of the control is designed to operate satisfactorily up to 125 volts on a 110 volt 60 cycle machine. On machines using Type A, C or D controls, excessively high voltage may cause the starting arm to stay closed after the motor has come up to speed. This causes an abnormally high current to be drawn from the line and the overload will trip. If the machine continues to run satisfactorily after the starting arm has been pulled down and the starting contacts opened manually, it is usually an indication of high voltage.

If the voltage is not much over the 125, this condition can be remedied by adding small weights to the armature, so that the additional weight will be sufficient to pull the armature down after the motor has come up to speed.

Holes are provided in the armatures of the Type A, C and D controls for the addition of weights, if trouble arises from high voltage. In the case of the A or C controls, the proper weight can be made up from small screws, nuts and washers, using enough additional weight to obtain proper operation.

The weights for the Type "D" control may easily be made in the form of a lead slug and should be added to the top of the armature, in the hole provided. Care should be taken to get the correct weight without too much height, as this would interfere with the control cover.

12 BROKEN CONTROL SHUNT WIRES

On controls that have been in service for a long time, a broken shunt wire in the control may be found to be the cause of a machine not starting properly. These are the flexible wires used to connect the movable parts of the control. A broken wire can be replaced, but care should be taken that the same kind of stranded wire is used and that it is of the same size. The wire should be looped slightly to allow the parts free movement and so undue strains will not be put on it. After replacing any of these flexible wires be sure that they are not located in such a way that they will interfere with the operation of the control parts.

13 BELLOWS INTERFERENCE WITH MAIN CONTACT - TYPE D AND E CONTROLS

On some of the Type "D" and "E" controls it is possible for the bellows to interfere with the movement of the movable main contact. This occurs when a large diameter bellows is used and the bellows is installed in such a way that it is pushed up as far as possible towards the top of the control. The interference may not allow the main contacts to close and hence the machine will not start.

Present replacement bellows are of such a diameter that this trouble should not be experienced, but on the old controls, care should be taken when installing a bellows that the movable contact is free to move.

14 WEAK STARTING ARM SPRING - TYPE A, C AND D CONTROLS

If the starting arm spring in these controls is weak, the starting contacts may not close and the motor will not start. This can be easily checked by removing the cover of the control and observing the operation during starting, or by manually lifting the relay armature and seeing whether or not the spring lifts the starting arm and closes the contacts.

In the early Type "A" controls there was no shunt wire between the movable starting arm and the bracket on which it pivots. Therefore the full starting current could pass through the starting arm spring and this would anneal it. After a time the spring becomes too weak.

Where there is no shunt wire "pigtail", the entire starting arm should be replaced with one that does have the shunt, and the spring itself should always be replaced if it is found to be weak.

15 STARTING ARM STICKS - TYPE A, C AND D CONTROLS

If the starting arm sticks down after the relay armature has picked up, the starting contacts will not close and the machine will not start. On the end of the starting arm of the Type A, C and D controls is a rubber sleeve. After long periods of usage this rubber sleeve may soften and cause the arm to stick so that it cannot raise. Talcum powder sprinkled where the sleeve rests will usually eliminate the trouble, but it is best to replace the rubber sleeve.

16 FLAPPER STICKS TO SHUNT COIL CORE - TYPE E CONTROLS

If the flapper type armature of the Type "E" control sticks to the shunt coil core, the starting contacts will be held open and the machine will not start. The pole face of the coil is cadmium plated to reduce the effects of residual magnetism, which would hold the flapper down, and it is possible that this residual magnetism is the trouble. If this is found to be true, though such cases are rare, it will be necessary to replace the control.

However, the trouble can usually be traced to some foreign substance on the pole face, such as the remains of a bug. Clean the pole face and the flapper with a rubber eraser.

CAUTION: Do not use a file as this will remove the cadmium plating and sticking from residual magnetism will result.

The Type "E" control can be sealed against bugs and dirt with a set of sealing bushings, Cat. No. 58X10. The "Off and On" window can be sealed with cellophane and adhesive tape, and other small openings such as around the bellows tube can be sealed with lacquer. The rubber bushings furnished go on the shafts of the temperature knob and reset lever where they come through the control cover. The asbestos washer is used around the base of the resistor that extends through the control base. Make sure that the bushings do not interfere in any way with the operation of the control parts.

17 BURNED, DIRTY AND WELDED CONTACTS

If either the main contacts or starting contacts in the control are burned or dirty, they cannot operate properly and may cause tripping out complaints and erratic operation of the control. It is possible that the main contacts may weld together and cause continuous running of the machine.

Contacts in this condition should be carefully cleaned, using a fine file or carborundum stone. When cleaning contacts be sure that a smooth face is obtained and that no filings or particles from the stone are left on the contacts.

CAUTION: Do not use sandpaper to clean the contacts.

18 OVERLOAD SET TOO SENSITIVE

The overload device acts to protect the motor and should always be properly adjusted. If the overload is set to trip too soon, it may trip during normal operation of the machine under a loaded condition. The overload can be checked and adjusted as explained under Overload Adjustments of the Control Section.

CAUTION: Never set the overload so that it will not trip within the normal time, as the machine may be damaged. If the overload is operating properly and still trips the machine off, the cause of the overload should be located and corrected if possible. Refer to other troubles that will cause tripping out complaints.

It should also be remembered that under heavy loads, such as during the period when the cabinet temperature is being cooled from a warm condition, the overload may trip out. This is normal under certain extreme conditions, and the overload should not be adjusted beyond the proper limits to eliminate it.

Educational Service

EDUCATIONAL SERVICE

Note - A fairly large proportion of service on electric refrigerators is caused by failure on the part of the user to understand the normal operation, the limitations or proper use of the refrigerator.

1 EXCESSIVE LOAD ON MACHINE

When the machine is heavily loaded such as during the period of cooling the cabinet temperature from a warm condition or during ice freezing, the current drawn by the motor may be sufficient to trip the overload. The machine should be restarted manually and allowed to run until the load has been reduced enough so that the machine will continue to run without tripping.

2 EXCESSIVE LOADING OF CABINET

The cabinet temperature will rise when a large amount of relatively warm food or beverages are placed in the cabinet, and if warm food is constantly being put in, the temperature will average somewhat above normal. During ice freezing, particularly when all trays are being frozen at once, much of the cooling capacity is diverted to the freezing of the water. Under heavy load and high temperature conditions, the cabinet air temperature will be higher than normal, while the water is being frozen. These conditions will also obviously cause a higher percent running time and higher power consumption.

3 EXCESSIVE CABINET DOOR OPENING

Whenever the cabinet door is opened, warm air enters the cabinet and excessive openings will cause the cabinet air temperature to stay above normal. Under humid conditions, a much greater load is placed on the machine to condense the moisture from the air. Naturally the cabinet air will be somewhat above normal temperature during excessive door openings and the greater load will result in a higher percent running time and a greater power consumption. Especially in humid weather it is recommended that the cabinet door be left open as little as possible.

4 EXCESSIVE ICE FREEZING

During ice freezing the machine will tend to run a very high percentage of the time, and if a lot of freezing is done, the overall running time will be increased with a natural increase in power consumption. Also during heavy ice freezing, the cabinet temperature may be slightly above normal.

5 EXCESSIVELY HIGH ROOM TEMPERATURE

The capacity of a refrigerating machine and the heat leakage into the cabinet depend on the room temperature. In an excessively high room temperature the load on the machine will be heavy and combined with the usage of the refrigerator, it may result in a slightly higher than average cabinet temperature. The percent running time and power consumption will be higher than average. In extremely high temperatures, the ice freezing may be slowed up somewhat due to the extra load.

6 EXCESSIVELY LOW ROOM TEMPERATURE

With the same control setting, the cabinet temperature varies with the room temperature. If the room temperature drops below 60 F, the normal temperature setting may be such that freezing cabinet temperatures will result. The control should be turned to the warmest position making use of internal and external adjustments and if this is not sufficient it is probably best to turn the machine off during the cold period. The control will have to be set colder when warm weather returns.

When the room temperature is quite low, the percent running time is greatly decreased and this may result in slower ice freezing, since to freeze ice, the machine must run enough to hold a fairly low evaporator temperature. Also, if the running time is decreased enough by the low room temperature, a partial defrosting of the evaporator may take place when the control is set warm.

It will be noticed that the machines are somewhat noisier in low room temperatures, but will return to normal when the room temperature is raised.

7 RESTRICTED AIR CIRCULATION TO CONDENSER

If the air circulation to the condenser is seriously restricted, the capacity of the machine will be reduced, resulting in a higher percent running time and greater power consumption. Also, under heavy loading, the cabinet temperature may be somewhat above average.

Never lay anything over the condenser or build too closely around it, as unrestricted air circulation is essential to the satisfactory operation of the machine. At least one complete side of the condenser should be open with six inches clearance over the dome of the machine.

8 RESTRICTED AIR CIRCULATION IN CABINET

Air circulation within the cabinet is necessary to insure uniform temperature distribution. If it is restricted by excessive crowding of food or by placing coverings over the shelves, the cabinet air temperature will be higher than it should be in some areas.

9 POOR CONTACT OF ICE TRAYS

Good contact between the ice trays and the evaporator is necessary for the best ice freezing. When there is a heavy coating of frost on the evaporator, the trays will not be in good contact and slow freezing will result. In the evaporators where there are metal freezing blocks on which the trays rest, the freezing blocks themselves must make good contact with the evaporator and should be frozen in for the best results.

10 USE OF RUBBER TRAYS FOR FREEZING

Rubber trays are used only because of the ease they offer in removing ice cubes. However, rubber is a poor heat conductor, and water in a rubber tray will take approximately three times as long to freeze as in a metal tray. Therefore, when the fastest freezing is desired, use metal trays.

11 LOCATION OF TRAYS IN THE EVAPORATOR

In some of the machines with narrow evaporators, one ice tray rests on top of another. Normal freezing cannot take place unless the tray is in contact with the evaporator or freezing block. Therefore, the tray to be frozen should be placed on the bottom, and the upper position used for keeping the ice after freezing. In "open" type evaporators the trays should also be centered in the evaporator from back to front.

12 FREEZING AND KEEPING DESSERTS

Complaints sometimes arise because the user notices that desserts and ice creams do not freeze as fast as water and do not remain frozen as well. Due to the constituents used in desserts, they usually freeze at a lower temperature than water. This means a longer freezing time will be necessary and the coldest possible temperature needed to keep the dessert.

Desserts should be frozen and stored in metal trays that are frozen to the evaporator or to the metal freezing blocks. The coldest control temperature setting should always be used.

13 NO CHILLER TRAY

Uniform cooling of the cabinet depends on proper air circulation within the cabinet. The refrigerator is designed to maintain proper temperatures with the glass chiller tray in place underneath the evaporator. If the machine is run without the chiller tray, the cabinet temperature will be too low. The user should be cautioned to leave the chiller tray installed even though it is not being used for storage. The chiller tray will also catch the ice and water from the evaporator in case of interruption of the electrical service.

14 MACHINE NOT LEVEL - DOUBLE EVAPORATOR MACHINES

On machines such as a DR-3 that have two side by side evaporators, it may be noticed that at times one evaporator is not frosting normally. This can be caused by the machine not being level and more refrigerant feeding into one evaporator than the other. The machine should be leveled, and if this does not correct the trouble, Monitor Testing may be necessary.

15 EXCESSIVE DOOR OR CABINET TOP LEAKAGE

The cabinet top and cabinet door are equipped with gaskets to reduce heat leakage into the cabinet. If the gaskets are not sealing, the leakage may be enough to cause high cabinet temperatures and will result in enough extra load to cause the unit to run a greater percentage of the time. It is likely that frost will collect on the evaporator rather rapidly. There should be a definite drag on a .003 inch feeler gauge placed between the gasket and the sealing surface.

When inspecting a refrigerator, the gaskets should be carefully checked, since after long periods of usage, the gaskets may deteriorate or flatten out. The hinges and latch should also be checked, since wear on these parts may be the cause of a poor door seal.

16 VIBRATION

Vibration complaints will usually be influenced by the floor on which the refrigerator is standing or by the gliders under the feet of the cabinet. The cabinet must be resting solidly on its legs and the flooring should be as firm and solid as possible. It may be found that the rubber gliders under the cabinet have become hard and should be replaced with newer and softer ones.

There will, of course, be a certain amount of vibration during stopping of the machine, but if the cabinet is on a level and solid mounting, this should not be objectionable.

Installation of Refrigerating Machines

INSTALLATION OF REFRIGERATING MACHINES

Every distributor and dealer will find by experience the equipment most suitable and the method most efficient for handling refrigerating machine installations. However, the following general suggestions may be found useful

UNCRATING MACHINES

A reasonable amount of care should be used in removing the refrigerating machine from the crate. The crates are especially designed for use with Type DR machines. First, remove the cover of the shipping crate. A good nail puller should be used for this work. Also make sure that all loose nails are pulled out so that the finish on the refrigerating machine will not be damaged when removing it from the crate. The portable lifter can be used to remove the refrigerating machine from the crate.

INSPECTION

At the time the refrigerating machine is uncrated examine it carefully for possible damage during shipment. If damages are found, examine the crate and as nearly as possible ascertain the reason for the damage so a damage claim can be placed.

ASSEMBLY OF REFRIGERATING MACHINE TO CABINET

The refrigerator cabinet should be put in place before the machine is installed in it, as it simplifies the operation and avoids moving the entire weight of the machine and cabinet combined. If the lack of head room, or some other condition, prevents this operation the machine and cabinet should be assembled and placed on a lifting dolly so that it can be easily pushed in place.

With the cabinet in place ready to receive the machine, the top gasket is put in place on the top of the cabinet as shown in Fig.133. The sponge rubber gasket is placed on the ledge inside the top of the cabinet. The use of this sponge gasket is not essential and it can be omitted. This gasket was not supplied with later models. The portable lifter, Cat. No. 11X384 can be used to place the refrigerating machine in the cabinet.

A check should be made to see that all gaskets remain in place as the machine is lowered into the cabinet. On the DR-1 machines special sponge rubber gaskets were used which fit into a groove at the top of the cabinet.

When the machine is being installed in the cabinet, care must be taken not to damage any refrigerant lines. On some models there was only a small clearance between the refrigerant lines at the back of the evaporator and the rear of the cabinet liner.

Before lowering the machine into the cabinet examine the No-Oxide cloth around the box top opening of the cabinet. If it is loose at any point iron the cloth down with a piece of wood. In some cases it may be necessary to reseal open corners or joints with melted No-Oxide grease applied with a brush.

As indicated above, after the machine has been lowered into the cabinet, check the seal of the cabinet top gaskets. *The seal of the outer or upper gasket is most important and must be made tight.* The outer seal is required to prevent leakage of warm moist air into the cabinet. Any such air leakage must be prevented to eliminate possibility of heat and moisture leaking into the cabinet this way as it may result in excessive operation and frosting of the evaporator and possibly water soaked insulation.

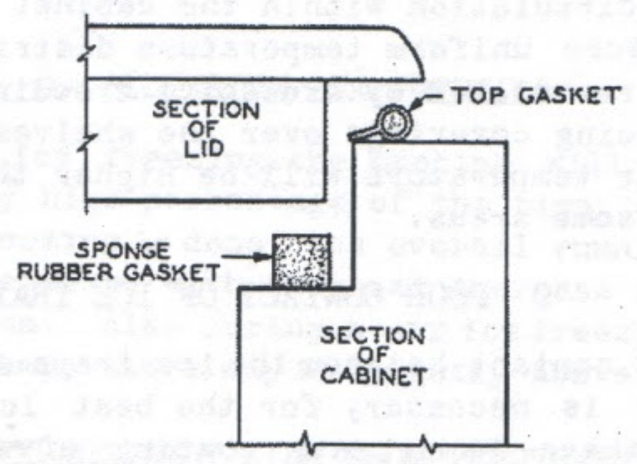


Fig.133 Cabinet Top Gaskets

REFRIGERATOR LOCATION

The refrigerating machine is designed to operate most economically and to provide maximum refrigeration in the temperature surrounding the refrigerator of approximately the daily average room temperature of the home. Installation on porches or in exposed rooms, where extremely low temperatures prevail, are not satisfactory, because this may cause food to freeze on cold nights. The function of the refrigerator is to maintain the food temperature below that of the surrounding air. Furthermore, the machine will be more noisy in a cold place.

The proper operation of the refrigerating machine depends on the circulation of air through the condenser coils. If the machine is installed in an open room, with air circulating on all sides, with the exception of the back, the operating cost will be a minimum. If the machine and cabinet are installed in a niche in the wall there should be a minimum of at least 6 inches left open above the top of the machine. It is preferable to have the front of the machine left open but in some cases where built-in installations are required be sure to have the minimum height of 8 inches and if it is necessary to have grille work there must be a minimum of 60 per cent open work. Failure to follow these instructions will result in excess cost of operation and possible damage to the machine.

The refrigerator should be placed on a solid part of the floor and should not be pushed up tightly against the wall which will act as a sounding board. The cabinet should be installed level and so it sits firmly on all four legs.

Cabinet Adjustments

Cabinet adjustments for the most part do not require technical knowledge but rather lend themselves to simple solutions which are apparent upon examination. However, the following general suggestions may be of some help to the serviceman.

CABINET DATA

Listed below are the various cabinet models, by manufacturer, on which Type DR Machines were originally used. The identifying symbols on the cabinet serial number plates are also shown.

Cabinet Model	*Manufacturer*	*Symbols*
G-35	G-E "All Steel"	None
G-40	G-E " "	None
G-55	G-E " "	None
G-75	G-E " "	None
G-100	G-E " "	None
G-135	G-E " "	None
G-175	G-E " "	None
P-44-E	G-E " "	None
P-55-E	G-E " "	None
P-67	G-E " "	None
P-85-E	G-E " "	None
PS-62	G-E " "	6SE
PS-65	G-E " "	6SE
PSS-62	G-E " "	6SE
R-5	G-E " "	LS
S-42	G-E " "	None
S-44	G-E " "	None
S-62	G-E " "	S6
S-67	G-E " "	None
S-85	G-E " "	None
S-100	G-E " "	None
S-107	G-E " "	None
S-140	G-E " "	None
S-146	G-E " "	None
S-180	G-E " "	None
S-182	G-E " "	None
S-62-S	G-E " "	None
S-100-S	G-E " "	None
S-140-S	G-E " "	None
S-180-S	G-E " "	None
SS-42	G-E " "	None
SS-62	G-E " "	None
SS-82	G-E " "	None
SS-100	G-E " "	None
SS-140	G-E " "	None
SS-180	G-E " "	None
CS-45	Benjamin	None
DX-75	Jewett	None
DX-10	Jewett	None
DX-14	Jewett	None
DX-18	Jewett	None
P-4	Bohn	BS
P-4	Seeger	None
P-5	Bohn	B
P-5	Jewett	JL
P-5	Leonard	LL
P-5	Seeger	CL
P-5	Seeger	PL
P-5	Seeger	None
P-7	Bohn	B
P-7	Leonard	LL
P-7	Seeger	CL
P-9	Seeger	CF
P-12	Seeger	CF
P-12	Seeger	CF
P-42	Bohn	BS
P-42	Seeger	None
P-63	Bohn	B
P-83	Seeger	SS
P-110	Bohn	9SB
P-134	Bohn	13SB
P-170	Bohn	17SB
P-4-180	Bohn	None
PB-5	Bohn	E
PB-5	Seeger	None
PB-7	Seeger	CB
PB-9	Seeger	CT
PB-12	Seeger	CT
PB-16	Seeger	CT
PL-13	Bohn	B
PL-13	Seeger	CF
PL-17	Bohn	B
PL-17	Seeger	CF
PL-95	Bohn	B
PL-95	Seeger	CF
P-55-S	Seeger	S
PS-5	Bohn	5SB
PS-7	Bohn	7SB
PS-8	Seeger	SS
PS-13	Bohn	13SB
PS-17	Bohn	17SB
PS-45	Bohn	None
PS-45	Seeger	None
PS-55	Bohn	None
PS-62	Bohn	6SB
PS-95	Bohn	9SB
PS-4-17	Bohn	174SB
PS-4-18	Seeger	None
R-5	Heintz	HL
R-7	Heintz	HL
RB-5	Harder	D & RB
RB-7	Erie Art Metal	7AB
RB-9	Erie Art Metal	9AB
RB-9	Puffer-Hubbard	PF
RL-95	Bohn	BL
RL-95	Erie Art Metal	9AL
RL-95	Puffer-Hubbard	PF
RS-5	Edison	N5EL
RT-5	Jewett	JL
RT-5	Puffer-Hubbard	PT
RT-7	Bohn	BL
RT-7	Erie Art Metal	7AL
RT-7	Jewett	JL
S-3	Jewett	J
S-5	Edison	N5EL
SD-35	Bohn	B
SD-40	Bohn	4SB

EXTERIOR TRIM

Caution should be exercised when replacing the exterior trim on lacquer and porcelain cabinets to prevent chipping. Chipping will result if the screws are drawn up too tight. It is recommended that paper be placed under the trim on lacquer cabinets to prevent cutting the lacquer, which will result in the rusting of the panels. This should be practiced whenever a panel is replaced on a cabinet.

The trim is held in place with wood screws on the wood frame cabinets. Where the screw holes have become enlarged or the threads stripped, plug the old holes with wood plugs and reset the screws. Machine screws are used for the "All-Steel" cabinets such as the PS-65 cabinets. If the threads in the cabinet are stripped, retap the holes and if necessary use larger screws.

LEGS

When replacing legs, be sure to line up the flanges of the leg with the side of the cabinet. If the threads for the lag screws are stripped in the wood framing, replug the holes with wood and redrill, using a drill smaller than the lag screw. Under no circumstances should the lag screw be driven into the frame work unless a hole is first drilled in the frame work, as failure to do this will result in splitting the wood.

On the "All-Steel" cabinets, the legs are held in place with machine screws. If the threads are stripped in the plate, it will be necessary to retap the threads and use a larger screw.

WOOD MOULDINGS

To remove wood mouldings, which are nailed on, use a thin nail punch and drive the nails into the moulding and then use a flat chisel and carefully pry loose by degrees. When replacing the moulding, it will be necessary to drive the nails which held the moulding in place, at new points. When replacing the quarter round moulding, on the door, drive the nails at a 45 degree angle. Set the heads of the nails below the surface of the mouldings. Fill all holes and crevices with putty and refinish the moulding with a high grade, odorless spar varnish, one or two coats if necessary.

Some of the cabinets have wood mouldings fastened in place with wood screws, which are very easily removed.

TEXTOLITE STRIPS

On "All-Steel" cabinets and later models of wood frame cabinets the textolite strips are removed by taking off the monel corner strips and the monel strip-screws that hold the strip in place. The old strip can then be removed and replacement strip put on by the reverse procedure.

Where wood screws are used, enlarged or stripped screw holes can be corrected by using wood plugs and resetting the screws. Where machine screws are used, as in the "All-Steel" and "Seeger" cabinets, if the screw hole threads are stripped, retap the holes and use oversize strip screws if necessary.

Care must be taken to see that the corners are thoroughly sealed before putting on the monel corner pieces. The corners should be sealed with No-Oxide Tape.

Strips of No-Oxide tape or cloth should be used underneath each edge of each Textolite strip as a gasket and to form a seal.

GASKETS

On the wooden door type of cabinets, when it is necessary to replace the gasket, remove the wood moulding at the exterior door panel and take off the old gasket. For the "Bohn" cabinets it is necessary to remove the outer door panel in order to remove or replace the gasket, except where these cabinets have the "Button on" type rubber gaskets.

Start the replacement gasket at the center bottom edge of the door and fasten it to the door with non-corrosive staples or tacks. Be sure to notch the gasket (except for Bohn Cabinets) as shown in Fig.134 and fit the corner as shown in Fig.134. A Markwell No. 176 or similar tacker is a very handy tool to have for securing the gasket in place.

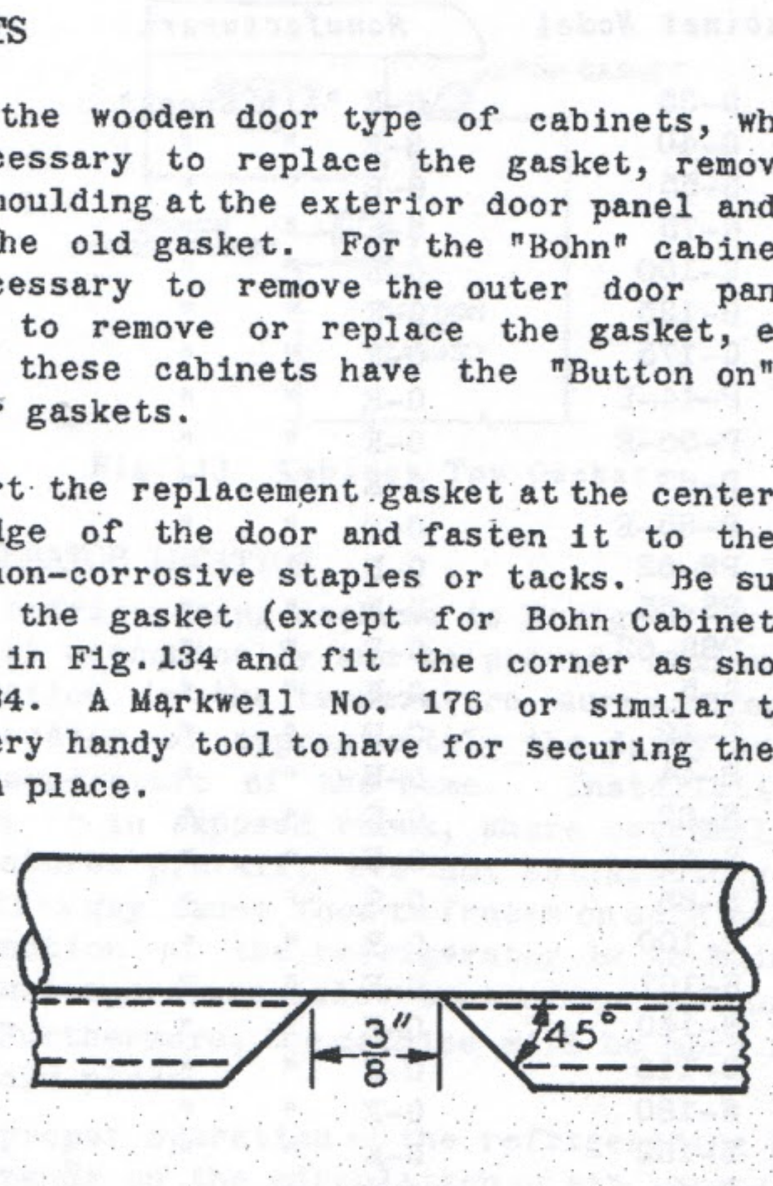


Fig.134 Notching and Fitting Door Gasket Corners

When replacing gaskets on doors, if the door is equipped with two gaskets, the inner gasket should

be eliminated and the outer gasket only, replaced. On the PS line of cabinets it will only be necessary to remove the exterior door panel to remove the Wirf Gasket, if they are not equipped with the button type rubber gasket.

To replace the button type rubber gasket, pull old gasket off and put the new gasket on the cabinet by forcing the lugs of the gasket into holes in exterior door pan, with a blunt tool or pencil.

SHELF SUPPORTS

When it is found necessary to replace a shelf support, remove the side panels and insulation. The nuts and screws that secure the shelf support, will then be exposed. By removing the nut, the old shelf support may be taken out and replaced with the new one. When replacing the insulation, make sure that the paper envelope is not torn. If this envelope is torn, be sure to seal up the tear with gummed paper.

RESETTING SCREWS

Wherever wood screws are used, if the screw hole has become worn and will not hold the screw, it should be tightly plugged with wood and the screw reset. On the "All-Steel" cabinets, the screws are set in plates. If the threads are stripped the plate should be retapped and a larger screw used if necessary. Caution must be taken on "All-Steel" cabinets, when setting up the screws, not to strip the threads.

REPLACEMENT OF DOORS

When rehanging doors, the cabinet should be laid on its back on a padded surface. Care must be taken to see that the door is carefully centered in the center of the door opening. (Failure to do this will cause a poor door seal and throw the latch and strike out of line.) If the holes for the screws and the hardware do not match up, plug the holes with wood and reset the screws, which will put the hardware in the proper place and hold the door in the proper position. This is possible as the holes in the exterior door panel and front panel are larger than the screws used on the hardware, which will allow the necessary leeway.

On the "All-Steel" doors, the same applies only that there is a clearance in that the holes in the hardware are larger than the screws themselves. Loosen the screws and then by moving the door up or down it can be centered. After having rehung or replaced the door, make sure that the gasket seals at all points.

If it is impractical to lay the cabinet on its back, when replacing the door, measure exactly the width and length of the door and of the door opening. Subtract the width of the door opening from the width of the door and the length of the door opening from the length of the door. Using one-half the difference of the widths, measure out from one side of the door opening and draw a light line with a soft pencil (never use crayon or a colored pencil) parallel with the side of the door opening. Likewise, using one-half of the difference of the lengths measure and draw a light line parallel with the top or the bottom edge of the door opening. Using these lines as guides, by lining up the edges of the door with them, when it is put on, the door will be centered in the door opening.

After tightening the hinge screws be sure to clean off the pencil lines.

WARPED DOORS AND IRREGULAR CABINET FRONTS

Before condemning a door of the wood frame cabinets as being warped, check with a straight-edge to make sure of this condition. A good many times it will be found that the door is not warped at all but that the cause for this apparent condition is due to the failure to remove the inner gasket on the door or that the front panel of the cabinet is not true. To correct this, remove the metal trim from the front of the cabinet and force the front panel out by placing cardboard between the frame and the panel where it is indented. This will true up the front panel of the cabinet and correct a poor door seal which makes the door look like it was warped.

While doors of "All-Steel" construction may be twisted out of true, they *do not* warp. So called "warped" doors of this construction can be straightened. Here again it is possible that the condition may be due to the front of the cabinet being irregular. Refer to "Door Seals", Page 79 for corrective measures.

HARDWARE

Sets of hardware with adaptor plates are available to replace the old draw-bolt type of hardware with the later style. When it is found necessary to make a change of this kind, the adaptor plates must be used.

When replacing latches, strikes and hinges, paper or fibre shims should be used under the replacement parts to insure against chipping. All screws should be drawn up securely to insure a proper seal and prevent sagging of the door.

If the latch does not work automatically when the door is slammed and the door is properly centered on the cabinet, it may be necessary to adjust either the upper or lower lug of the strike. This should be done with a block of wood and a hammer or a rubber hammer. Care and caution should be taken so that chipping of the finish will not be the result of too hard a blow. It may be necessary to either raise or lower either of these lugs by this method. The distance to raise or lower them is entirely dependent upon the way in which the latch engages with the strike.

PANELS

When replacing porcelain or lacquer panels, extreme care should be exercised to prevent damaging or chipping of the panel. Do not subject the panel to any undue strain as checking or chipping will result. This is particularly true of porcelain parts.

CHANGING EXTERIOR DOOR PANELS

On the "All-Steel" line of cabinets and including the "Seeger" cabinets with Textolite strips, to change the exterior door panel, remove the door from the cabinet, remove the monel corner pieces and remove the outside Textolite strip screws which hold the exterior panel to the Textolite strips. The panel then can be taken off and replaced by a new panel, by the reverse method.

On porcelain and lacquer wood frame cabinets remove the door from the cabinet, leaving the hinges attached to the cabinet, and remove the latch from the door. Lay the door on a padded surface. Lift the panel off the door proper by raising the edge from the hinge, or latch side, as the case may be, and disengage the other edge from the two lugs that hold it in place. When replacing the new panel be sure these lugs are engaged and hold the edge of the panel properly before lowering the panel into place against the door. Then replace the latch and rehang the door.

On the Leonard, Jewett and Edison line of cabinets it is impossible to remove the exterior door panels.

CHANGING INNER DOOR PANELS

Remove door and place on well padded surface. Remove quarter-round moulding, the screws and nails holding the pan in place. Remove the panel. The new panel is put on in the reverse procedure. If the door has two gaskets, remove the inner one.

On the Erie Art Metal and Edison cabinets it is impossible to replace the inner door panel.

On the "All-Steel" line, including the "Seeger" cabinets with Textolite strips, remove the corner pieces and all screws from the Textolite strips. Remove the tapping strips which are loose from the inner door panel. The Textolite strips should then be assembled, with the tapping strips, to the new inner door panel. The tapping strips are accessible at this time on the inner door panel and can be held in place while replacing the screws. This assembly is then replaced on the outer door panel with the insulation in place and secured by the outer row of Textolite strip screws.

CHANGING END PANELS

To remove and replace end panels, put cabinet on its side, using a padded block or rest. Remove the monel trim and screws or nails that hold the panel in place; also remove the legs on that side. Pull out nails found in the bottom flange of the panel. Be sure to line up replacement panel and center it before securing.

CHANGING FRONT PANELS (ONE PIECE)

To replace a front panel, lay the cabinet on its back on padded strips. Remove the metal trim around the front, remove the doors, hardware and front legs. Pull out the nails found in the bottom flange of the front with nippers. When the trim has been removed there will be found at each corner of the front panel a "V" opening in the flanges. If a screw-driver is inserted at one of these points and followed around the flange, the front panel can be removed without removing the door jamb strips. To put on a new front, clean off all the old cabinet maker's cement found on the frame and apply a new coat of cement about 1/16" in thickness over the entire wood surface. Place the new front panel down on the cabinet and lightly press the flanges around the door opening in the slots formed by the jamb mouldings and the framing. Apply all hardware, setting up all screws lightly. After twenty-four hours the screws can be tightened up and, after making sure the front panel is level, the door hung.

CHANGING FRONT PANELS (PIECED)

a Lay cabinet on its back on well padded strips. Remove doors, legs and hardware on cabinet when necessary.

b Bottom Rail. Remove front legs; remove bottom side jamb moulding. Loosen the metal strips holding part in place and remove panel. Replace by using reverse procedure.

c Top Rail. Remove nameplate, and metal corners and trim across top of front. Remove upper door jamb moulding and side jamb moulding; loosen metal straps and remove panel. To replace use reverse procedure.

d Right or left hand stiles. Remove doors from cabinets and hardware where necessary, leaving hinges attached to door. Remove metal trim from side repaired and top trim. Remove jamb moulding from side to be repaired. Loosen metal straps holding panel in place and remove panel. To replace, use reverse procedure.

e Mullions. Remove jamb mouldings on either side of panel. Remove strike. Loosen up metal straps holding panel in place and remove panel. To replace, use reverse procedure.

CHANGING LINERS ON "ALL-STEEL" LINE OF CABINETS

Lay the cabinet on its back. Some padded surface is preferable to prevent scratching the back of the outer shell.

Note - On double door cabinets, the sealing cover under the top panel should be removed. A blow torch should be used to soften the sealing compound used in the grooves around the cover. By softening this compound, the cover can be easily removed and if care is taken the cover can be used again. The insulation found under the cover should be removed.

On the 7 and 8 foot cabinets, the top cover should be removed, together with the small pieces of insulation around the top of the liner. There is no sealing cover on these cabinets.

Remove the door or doors from the cabinet.

Remove all the Textolite strip screws, textolite strips and monel corner pieces. If the No-Oxide tape is destroyed, which forms a gasket for the Textolite strips, new tape should be put on before reassembling the job.

Using a flat, wide board, or if on a double door cabinet, use two boards, to pry the liner out. Care must be exercised not to bend the cabinet flanges or break the insulation.

Before attempting to put in the new liner, check the following points:

a All insulation must be in place. See that there are no broken pieces.

b Inspect the new liner for chips.

c See that the tapping strips for the jamb strip screws are fastened to the liner.

Insert the liner and force into place. Be sure the liner is put in place evenly and no trouble will be encountered with having it slide in easily.

Replace the Textolite jamb strips, using three or four screws at the middle of the strips but don't tighten them. Place the No-Oxide cloth in the corners and make sure the space between the jamb strips is filled. Next replace the metal corner pieces. Do not tighten any screws all the way until all screws have been put in place, to avoid unnecessary prying and straining of the Textolite. Tighten all screws.

Stand the cabinet upon its legs and replace the top insulation. If it is a two-door cabinet, straighten out the sealing cover and replace over the top insulation or replace with a new cover. Reseal the cover with No-Oxide cloth and melted No-Oxide grease applied with a brush. Replace the top cover.

REPLACEMENT OF SHELVES

The original shelves were properly adjusted at the factory to conform with the cabinet liner.

Sometimes it may be necessary to adjust replacement shelves to the particular cabinet or when liners are replaced, by bending the supporting tangs in or out, in a suitable clamping device, to make a snug fitting shelf. Care must be exercised not to bend the tangs at the welds or to spring the shelves into position, leaving the welded points under a strain. Loose shelves will rattle. Shelves should never fit so tight that they have to be forced into place, as they are apt to chip the porcelain on the liner.

DOOR SEALS

Poor door seal usually results in complaints of cabinet sweating inside, excessive frosting of cooling unit, high per cent running time, high power consumption, slow ice freezing, high cabinet air temperature, and possible sweating on the outside front of the cabinet.

Imperfect door seals may be located by the use of a 0.003-inch metal feeler. Locate the point of poor seal by inserting the feeler at various points around the door between the gasket and the cabinet front, with the door closed. If the gasket seals properly, there should be a definite "drag" on the feeler as it is pulled out from under the gasket.

If a poor seal is located, first check the gasket to see that it is not excessively worn. Check the hardware to see that it is not sprung or worn and that the screws are tight.

Often a poor door seal can be corrected by rehanging the door as described under "Replacement of Door"; by replacing the gasket; or by properly adjusting or replacing the hardware.

If, however, the poor door seal is caused by the door being sprung out of line, or by the front of the cabinet being out of line, it can be corrected as follows:

"ALL STEEL" CABINETS

(The operator should be provided with a straightedge approximately 2 inches longer than the long side of the door, a rubber mallet, a metal feeler approximately 1/32-inch thick and a screw driver.)

1 With the straightedge check the cabinet front on all four sides, approximately where the door gasket seats, to see if the front is straight. If it is possible to insert the 1/32 inch feeler between the straightedge and the face of the cabinet such points should be corrected.

If an unevenness does exist, it is very likely that the cabinet front will be bulged outwardly, generally at the center of the Textolite strip.

2 When the front is bulged outwardly, loosen the Textolite strip screws approximately 1½ turns on all four sides of the door opening - front side only, not on the liner side.

3 Pound the high point of the cabinet front and keep checking with the straightedge until a comparatively even, flat surface is obtained. If done properly this will not in any way injure the finish. When the front is straight, tighten up all the screws.

4 If the cabinet front is found to be bulged inwardly, it will probably be found necessary to remove the Textolite strip at that point and pull the front of the cabinet out so that it makes a bulge forward.

Replace the Textolite strip, thoroughly tightening the screws on the liner side by leaving the outer screws loosened 1½ turns. Proceed in the same manner as for high points on the cabinet front.

5 Now firmly close the door and check the door seal by inserting the 0.003-inch metal feeler at various points around the perimeter of the door under the gasket.

If the gasket is not properly seated at all points, loosen all Textolite strip screws around the outer door panel side of door. Slam the door once or twice rather severely to let it take the shape of the cabinet front. Check the seal again and if found satisfactory tighten the strip screws thoroughly to hold the outer door panel in place.

If not found satisfactory, repeat the process and try springing the door farther with the hands.

If the door is still out, straighten it by striking the rolled edge at the open places sharply with the rubber mallet. Care should be taken to strike the radius only. Never hit the flat face of the door, as it will dent.

When the correct seal is obtained, make certain that all the Textolite strip screws are tight.

Practically all cases of apparently "Warped" doors of "All-Steel" construction can be corrected in the field, and a good door seal obtained by following the above procedure. Shimming of the hardware as covered under "Wood Frame Cabinets" can also be effectively used to correct door seals on the "All-Steel" Cabinets.

WOOD FRAME CABINETS

Due to the fact that most doors on cabinets other than the G-E "All-Steel" have doors with wood frames, it is possible for the door to warp under certain conditions. However, do not condemn the door without checking it and the cabinet front.

If the cabinet front is found to be out of line or uneven, correct the condition by following the procedure under "Warped Doors and Irregular Cabinet Fronts".

If the cabinet front is even, the door gasket is in good condition or has been replaced and the hardware is not noticeably worn, good door seals can be obtained by one or more of the following methods.

a Adjust the strike. (Refer to "Hardware").

b Use of shims under the latch. This will force the door to close tighter on the latch side.

c The use of shims under the strike will "loosen" the door on the latch side. This should be necessary only if the strike cannot be adjusted enough to correct the condition.

d Use of shims between the hinges and outer door panel will force the door to close tighter on the hinge side. If used under only one hinge, that corner of the door will be closed tighter.

e If the door is "hinge bound" that is, it closes too tight on the hinge side so the gasket is "pinched" as may happen when a new gasket is installed, shimming between the butt of the hinges and the cabinet proper will relieve the pressure. "Hinge bound" doors may cause a poor seal on the latch side.

f By shimming under the butt of one hinge not only will that corner of the door be loosened some, but the diagonally opposite corner, on the latch side, will be closed tighter.

g The use of over size gaskets, together with proper shimming of the hardware can, in some instances, be used to obtain good door seals, if the door is slightly warped.

h Badly warped doors can only be corrected by replacement.

ODORS

Very little trouble may be expected from odor complaints if proper care is taken of the refrigerator. There is nothing used in the construction of the cabinet that should cause an odor. All foods should be kept in covered containers, especially those which have strong odors and also those which readily absorb odors. Food odors are the greatest source of odor complaints. The interior of the cabinet should be thoroughly cleaned with warm water and soda periodically.

If the refrigerator is to be left standing for any length of time as several days or more with the unit shut off, remove all foods from the cabinet, thoroughly clean and leave the door ajar. If this is not done, odor trouble may result.

When odor complaints do arise, locate, if possible, the source of the odor and remove it. Sometimes odors may penetrate the insulation and be absorbed by it to be given off later. The cabinet should be thoroughly cleaned and aired out. Where the insulation has absorbed odors remove the insulation, after removing the liner, and air the insulation good or bake it up to 130° to 150° F. If the odor cannot be removed from the insulation, replace it. Before the cabinet is reassembled, thoroughly clean and dry each part.

MOISTURE IN THE INSULATION

While there is little possibility of excessive moisture being drawn into the insulation and condensing out, it can happen due to a poor top seal or some like condition.

It is also very possible that water, collected in the bottom of the cabinet liner, may work its way under the bottom door jamb strip and into the insulation. This factor is known to cause water-soaked conditions and it should be carefully guarded against in the following manner:

1 Caution the user against using a lot of water inside the cabinet when cleaning it, and sloshing it over the door jamb.

2 When removing a refrigerator from a home, be sure it has been defrosted and the ice cubes removed, or use some waterproof covering over the cooling unit to catch the water as defrosting takes place. (A large quantity of water will melt off the evaporator and be sloshed around in the bottom during moving.)

If the insulation becomes unduly moist or wet, its resistance to heat leakage will be reduced, resulting in high power consumption, high per cent running time and high cabinet air temperatures. This condition can also cause odor complaints. To correct, the insulation will have to be removed and dried out or replaced.

PATCHING PORCELAIN

Small chips on porcelain parts may be patched by means of the Cat. No. 58X85 Porcelain Patching Kit. The following Patching Instructions apply to Cat. No. 58X85 Porcelain Patching Kit.

PREPARATION OF SURFACE

1 Sand the chipped area thoroughly with a medium emery cloth such as Grade 280A to remove all traces of rust or loose enamel.

Caution: Make sure that the enamel is solid around the edge of the chipped area and that there is no trace of rust or dirt.

2 Clean the exposed metal and the enamel around the chipped spot. In the Patching Kit a bottle of cleaning fluid, Cat. No. 58X87 is included.
Carbona, thinner, or Acetone can also be used.

Warning: The surface to be patched must be clean and dry before applying the patching material.

3 The surface to be patched should be warmed to a normal room temperature of about 75 F.

APPLYING PATCHING CEMENT

1 If color match is important, tint a small amount of the patching cement (Cat.No. 58X86) with the tinting material (Cat. No. 58X89) furnished in the kit.

2 If the cement becomes too thick for proper brushing consistency, it can be thinned with the thinner (Cat. No. 58X88) furnished in the kit.

3 Apply an even coat of the patching cement to the exposed metal and extend it a short distance over the edge of the enamel (not over 1/4 inch).

4 Allow the cement to dry at least four hours.

5 A single coat should protect the surface but, if it is desired to fill up the cavity, two or three coats will have to be put on. Sufficient time should be left between coats to allow proper drying.

6 To smooth the top surface of the patch, use some thinner on the brush.

Caution: Do not sand the finished patch because it will remove the gloss.

CLEANING CABINETS

When cleaning cabinets, the interior should be washed with a solution of baking soda in warm water, or if soiled, with a mild soap and warm water and then rinsed with the soda water solution. A satisfactory solution can be made up of one tablespoonful of baking soda in four quarts of water. The use of soda water tends to remove residue food odors and "sweeten" the cabinet.

Caution: Never clean the interior of the cabinet or the evaporator with any cleaning agent which has an odor.

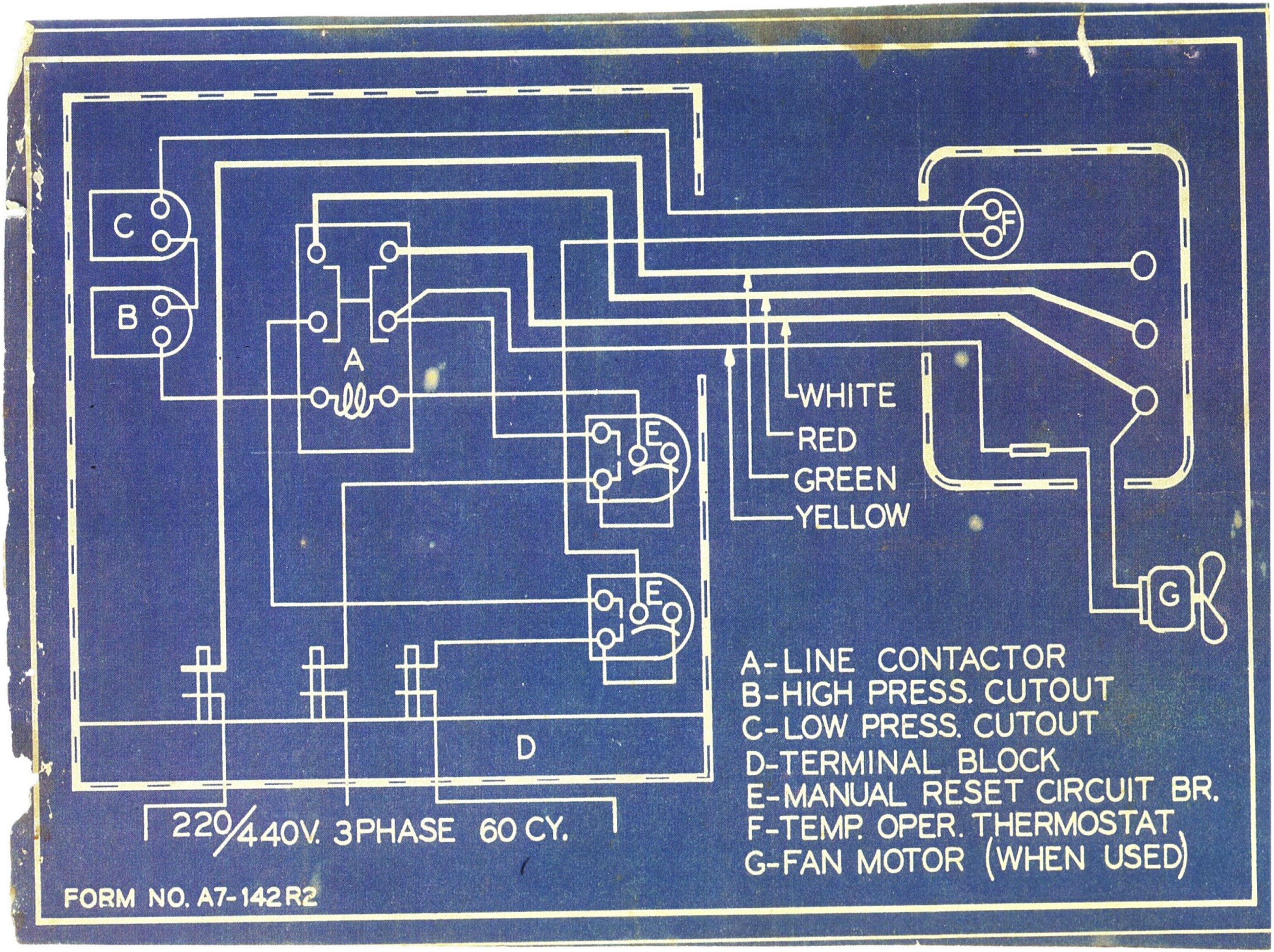
Caution: When washing the chiller tray, do not use hot water. Hot water may cause breakage.

It is suggested that the interior of the cabinet and the evaporator be cleaned each time the evaporator is defrosted.

For removing deposits on the evaporator caused by fruit acids, etc., use a good kitchen cleanser such as Bon-Ami, Bab-o, etc.

Use only a mild soap, such as Ivory, and warm water or General Electric Liquid Wax, Cat. No. A20R1, for cleaning the exterior of the cabinet.

Caution: The use of any of the standard cleaning compounds which depend upon abrasive or alkaline action will remove the gloss from the finish on the Glyptal finished cabinets.



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